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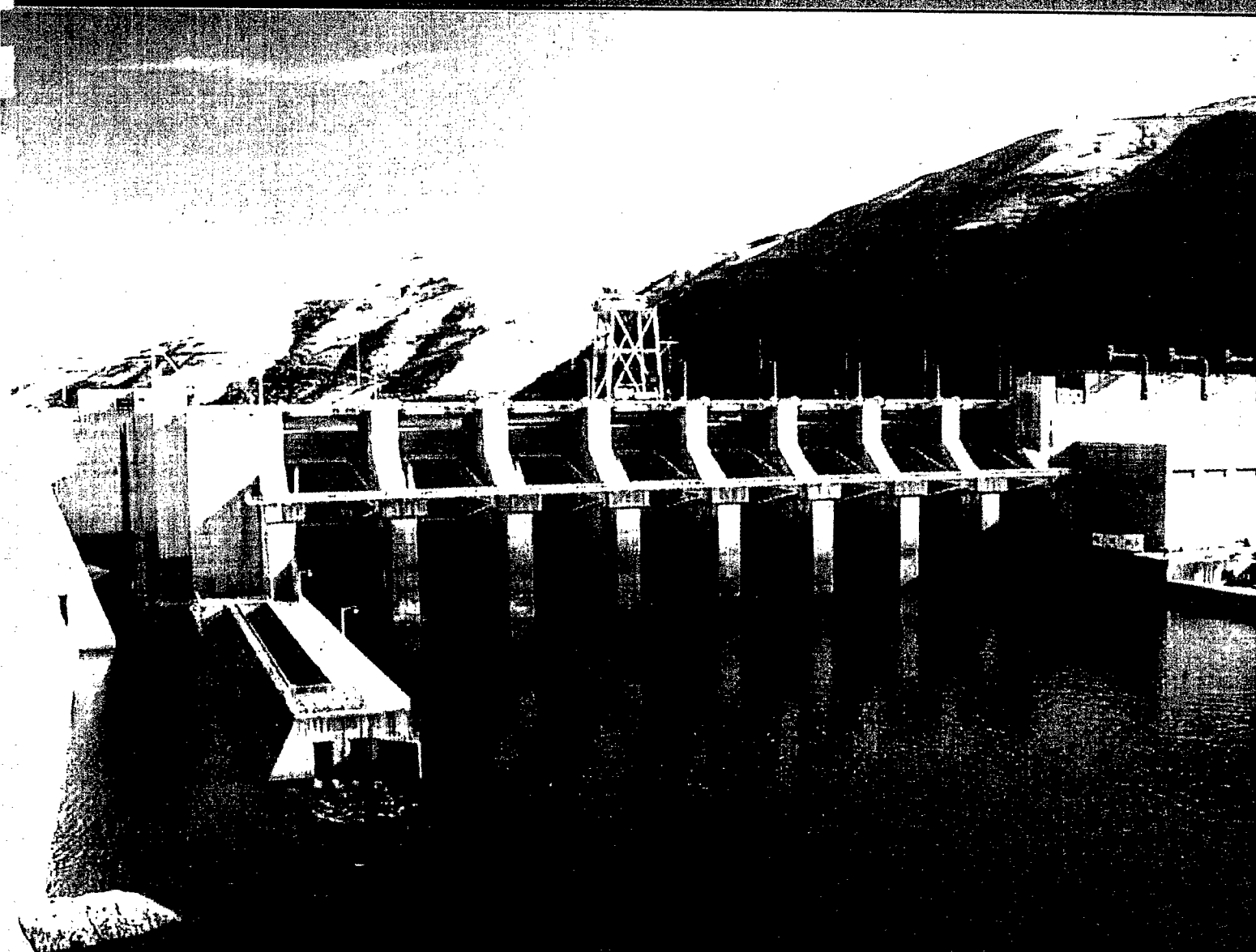
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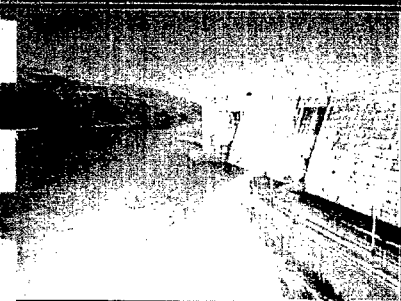
February 2001

Lower Granite Dam

Radial Gate Inspection and Testing



US Army Corps of Engineers, Walla Walla District



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LOWER GRANITE DAM RADIAL GATE INSPECTION AND TESTING

INTRODUCTION

Purpose

The Corps of Engineers, Walla Walla District, requires a comprehensive evaluation of the radial gates at Lower Granite Dam. The District retained HDR Engineering, Inc. to perform inspection and testing of the radial gates through Task Order No. 5 under Contract DACW68-00-D-0001. The task order scope of work includes review of project information, an initial meeting and inspection, comprehensive field inspection of the radial gates, testing of gate hoist machinery, recording trunnion movement, nondestructive testing of field welds, and preparation of a report.

Scope of Investigation

The scope of this investigation includes:

- Review of design, construction, maintenance and operations information provided by the District.
- Hands-on visual inspection of accessible upstream and downstream portions of eight radial gates.
- Visual inspection of the hoists and hoist equipment.
- Nondestructive testing of field splice welds.
- Testing of gates and hoists while operating.
- Recording trunnion movements while raising gates in both loaded and unloaded condition.
- A report including documentation of the design and operation of the gates and hoists, inspection and testing results, conclusions, and recommendations.

Limitations

The services under this contract include the professional opinion and judgment on the data and information reviewed. The conclusions and recommendations presented in this report are based on the information provided by the District and the inspection and testing of the radial gates and hoists. The inspection was visual only and only accessible portions of the components were inspected. Nondestructive testing was performed on field splice welds, but no laboratory testing was conducted in the course of the inspection.

PROJECT BACKGROUND

Project Description

Lower Granite Dam is located in southeastern Washington on the Snake River, 37.2 river miles upstream of Little Goose Dam, and 107.5 miles above its confluence with the Columbia River. The main project structures include a powerhouse, navigation lock, fish facilities, concrete non-overflow sections, and a rockfill embankment on the north shore. The dam is 3,200 feet long including the embankment. Construction of the project began in August 1965 and was completed in November 1975.

The spillway is 512-feet-long and is located about mid-river. The spillway consists of eight radial gate controlled bays separated by 14-feet-wide piers. The radial gates are each 50-feet wide by 60.15-feet-high. The gates are numbered 1 to 8 from left to right looking downstream. The spillway structure has a maximum height of 204.4 feet with the deck at Elev. 751.0. The spillway crest is at Elev. 681.0 and the top of gates at Elev. 740.0. The reservoir stores 483,800 acre-feet at normal full pool (Elev. 738.0).

The Spillway Design Flood (SDF) is 850,000 cfs. The spillway has a design capacity of 850,000 cfs at reservoir level Elev. 746.5. The maximum spillway capacity at normal full pool (Elev. 738.0) is 680,000 cfs. For the period from 1951 to 2000, the maximum flood of record was 332,000 cfs on June 18th, 1974. Peak flow outside the period of record was 409,000 cfs on June 5th, 1894. These values are computed from the flood marks by the U.S. Weather Bureau.

Gate Design and Construction

The Corps of Engineers designed the gates and project facilities. The gates were fabricated by Flint Steel Corporation of Tulsa, Oklahoma and Pacific Car and Foundry of Seattle, Washington. Stewart Machinery supplied the hoists.

The Walla Walla District provided copies of the engineering drawings and shop drawings for the gates. The gate and hoist specifications were also provided. The gates are very similar to the gates at Little Goose Dam. Notes in the District file indicate that the Little Goose calculations were used at Lower Granite Dam. See *Little Goose Dam Radial Gate Inspection and Testing* report for details on design. The following information was obtained from the Lower Granite Dam documents.

The 3/8-inch to 1/2-inch thick skin plate is supported by vertical ST10.5WF31 purlins. The skin plate is 3/4-inch thick on each end of the gate to act as a wear surface for the lifting cables. The purlins are connected to three horizontal plate girders. Each horizontal girder is supported by 14WF gate arms. The gate arms are braced with 14 WF members and there are ST7WF15 braces between the downstream flanges of the horizontal girders. Cable attachment brackets are mounted on the skin plate at the bottom corners. The horizontal plate girders, skin plate and cable

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attachment brackets are A537 Gr. A steel (Carbon-Magnesium-Silicon, Heat Treated for Pressure Vessels). All other members are A-36 steel.

The gate end frames were fabricated in two parts connected in the field with full penetration splice welds in the middle arms. The skin plate was installed in five vertical sections and joined by full penetration welds.

Each trunnion has a 24-inch diameter forged steel pin with a cast aluminum bronze bushing. The trunnions rest on a concrete girder that is anchored to the spillway piers with two groups of 48, 1-1/4 inch diameter prestressed bars.

The gates are raised and lowered by electric hoist units mounted on the deck above the gates. Eight 1-inch diameter wire ropes on each side of the gate wind on separate drums mounted on a common shaft. The hoist operating speed is approximately 1.1 feet per minute.

The gates have rubber J-bulb side seals and rubber wedge bottom seals. The side seal plates and sill beams are heated to prevent ice formation. The heating system consists of piping embedded below the seal plates. Electrically heated oil is automatically circulated through the piping when the ambient temperature drops below 32 degrees F.

Gate Operation

The gates may be operated by manual control from stations located near each hoist, but normally the gates are remotely controlled from the powerhouse. All of the hoists can be powered from a diesel generator set.

The spillway is operated to pass the desired discharge with the best hydraulic conditions in the stilling basin. Through experience it has been shown that the most desirable stilling basin conditions are achieved with uniform discharge through all eight gates. The gates are opened in one-foot increments during the fish passage season from March 1 through December 31 according to the operating sequence in Table 1. If the desired spill exceeds the capacity of all eight gates for this spill pattern, then the gate opening sequence is repeated.

Gate Maintenance

The District performs routinely inspects, tests, and lubricates the gates and hoists. Recent significant maintenance consists of:

- In the mid 1980s the upstream face of all gates were inspected and significant corrosion and wear was noted on the cable wear plates.
- The original coating for upstream and downstream portions of the gates was a four coat vinyl system. With the exception of spot painting, there is no indication that the gates have been recoated.

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Gate Number / Gate Stops								Total	Spill
1	2	3	4	5	6	7	8	Stops	(kcfs) ¹

(1) Forebay El. 737

1	0	0	0	0	0	0	0	1	1.75
1	0	0	0	0	0	0	1	2	3.50
1	0	0	0	0	0	1	1	3	5.25
1	1	0	0	0	0	1	1	4	7.00
1	1	0	0	0	1	1	1	5	8.75
1	1	1	0	0	1	1	1	6	10.50
1	2	1	0	0	1	1	1	7	12.37
1	2	1	0	0	1	2	1	8	14.25
1	2	1	1	0	1	2	1	9	15.99
1	2	2	1	0	1	2	1	10	17.86
1	2	2	1	1	1	2	1	11	19.61
1	2	2	2	1	1	2	1	12	21.48
1	2	2	2	2	1	2	1	13	23.35
1	2	2	3	2	1	2	1	14	25.27
2	2	2	3	2	1	2	1	15	27.14
2	2	2	3	3	1	2	1	16	29.06
2	2	2	3	3	2	2	1	17	30.93
2	2	3	3	3	2	2	1	18	32.85
2	3	3	3	3	2	2	1	19	34.77
2	3	3	4	3	2	2	1	20	36.67
3	3	3	4	3	2	2	1	21	38.61
3	3	4	4	3	2	2	1	22	40.53
3	3	4	4	3	3	2	1	23	42.45
3	4	4	4	3	3	2	1	24	44.37
3	4	4	4	4	3	2	1	25	46.29
3	4	4	5	4	3	2	1	26	48.21
3	4	5	5	4	3	2	1	27	50.13
4	4	5	5	4	3	2	1	28	52.05
4	5	5	5	4	3	2	1	29	53.97
4	5	5	5	4	4	2	1	30	55.89
4	5	5	5	5	4	2	1	31	57.81
4	5	5	6	5	4	2	1	32	59.73
4	5	6	6	5	4	2	1	33	61.65
4	6	6	6	5	4	2	1	34	63.57

Table 1: Gate operating sequence

INSPECTION

General

Wayne Edwards and Mike Haynes of HDR Engineering performed an initial site visit and inspection on April 5, 2000. Based on information collected during the initial inspection, HDR prepared an inspection plan and inspection sheets that were submitted to the District for review prior to the detailed inspection.

The inspection and testing of the spillway radial gates was performed from October 2nd through 9th, by Sam Planck, P.E., Heather Yee and Tony Barela, of HDR Engineering, Inc. Steve Schmidtkofer and Jim Knowles of K&N Electric inspected the hoists, took amperage measurements, and recorded observations during testing. Destry Hall and Jim Fisher of Kleinfelder performed nondestructive testing of field splice welds. Gary Struthers Associates was responsible for operation of the gates during the loaded and unloaded testing and moved the stoplogs between gate testing. Emerald Services, Inc., as a sub-contractor to Gary Struthers, provided water blast cleaning of the skin plate during the upstream face inspection. Gus Hernandez and Frank Gates (USACE) were present during the inspections and provided on site assistance. The weather was clear with temperatures ranging from 50 to 75 degrees F. The reservoir was full during the inspection. The upstream inspection of Gate 1 was not able to be performed initially because the surface collector was in place. Sam Planck and Amy Akins of HDR Engineering returned to the site on November 20th to complete the upstream inspection of Gate 1.

Procedures

Upstream Inspection & Testing

For the upstream inspections, stoplogs were placed in front of the gates prior to the inspection. The first part of the inspection was a rope access inspection of the bottom seal, bottom of the upstream surface of the skin plate and the hoist connections. During the inspection the gates were opened approximately three feet. At certain gates, the inspection under the bottom of the gate or measurements for racking could not be made due to excessive leakage through the stoplogs and heavy flows on the spillway. Racking measurements were recorded between the bottom seal plate on the gate and the embedded spillway seal. The upstream face of the gates was inspected from the spillway deck as each gate was raised to the full open position.

The second part of the upstream inspection consisted of the transverse, operational measurements at the trunnion, amperage readings while opening and closing, and the inspection of the upstream surface of the skin plate. Measurements were made to determine transverse movement of the trunnion hub versus the trunnion yoke at the initial, full open, and final closed position. During the gate opening, visible corrosion, debris and surface inconsistencies were waterblasted from the gate face for better condition assessment, see Photo 1. Amperage readings for the hoist were recorded at initial opening, during opening and during closing.

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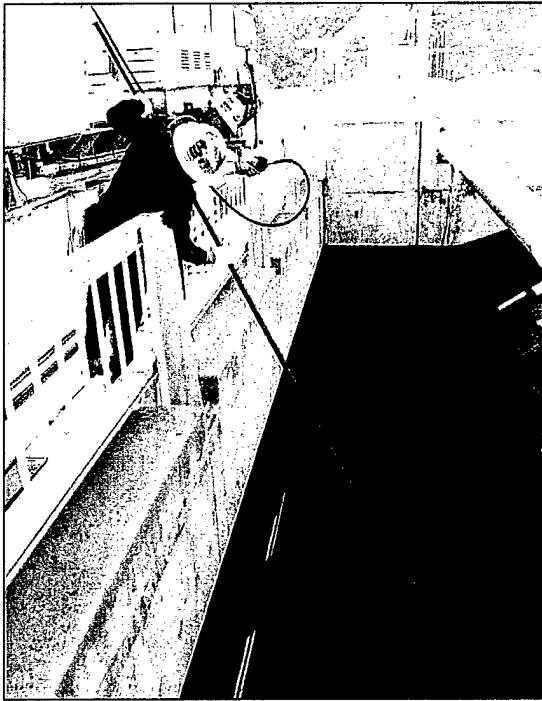


Photo. 1: Waterblasting of upstream surface of skin plate during full opening of gate.

Downstream Inspection

The downstream portions of all gates were inspected. The downstream gate members were inspected by climbing along the horizontal girders and radial struts, see Photo. 2. Inspection rigging for the downstream inspections was anchored to the gate hoist equipment and torque tubes. Visual observations were made for excessive sweep and camber of the main struts and were recorded only if an abnormal condition was observed.

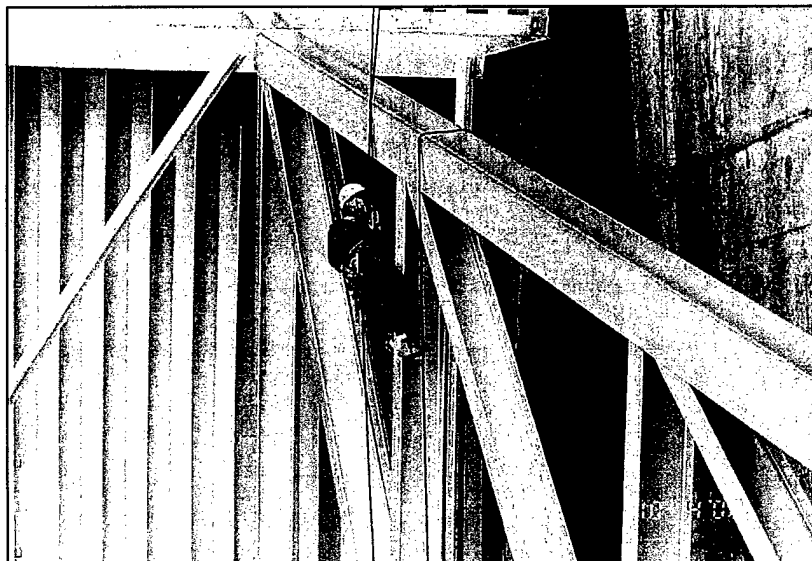


Photo. 2: Rope access downstream inspection.

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Operational Testing – Unloaded vs. Loaded

At the completion of the upstream inspection, with the stoplogs in place and the gate unloaded, dial gages were set at the trunnion to measure the vertical, transverse, and lateral movement of the trunnion hub versus the trunnion yoke. After initial readings were taken, the top stoplog was cracked open and the void was flooded, loading the gate. When the void between the stoplogs and the gate was completely full, final movement readings were taken. There was no gap present at the bearing between the trunnion yoke and the trunnion support beam, therefore, movement readings between the two surfaces were not made.



Photo. 3: Installation of dial gages at trunnion .

Operational Testing – Loaded

With the stoplogs removed and the gate fully loaded, the gates were opened to two feet. Amperage reading for the hoists were recorded at the initial opening, during the opening of the gate and during closing.

Nomenclature

The gates are identified as Gate 1 to 8, with 1 on the south end near the powerhouse looking downstream. Unless noted otherwise, all locations of observations, and notes pertaining to the radial gates are identified as right or left looking downstream.

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In the inspection sheets and this report, corrosion is classified as light, moderate or heavy as follows:

- Light - Surface rust with no flaking or packing. Rust can not be scraped off by hand.
- Moderate - Some flaking, beginning to pack, but thickness of the pack is less than approximately 1/16". There is no observable loss of section.
- Heavy - Pack rust with measurable or observable section loss to the member.

Member Designations

For the radial gate inspection observations and the photographs, the member designations indicated in Figure 1 apply.

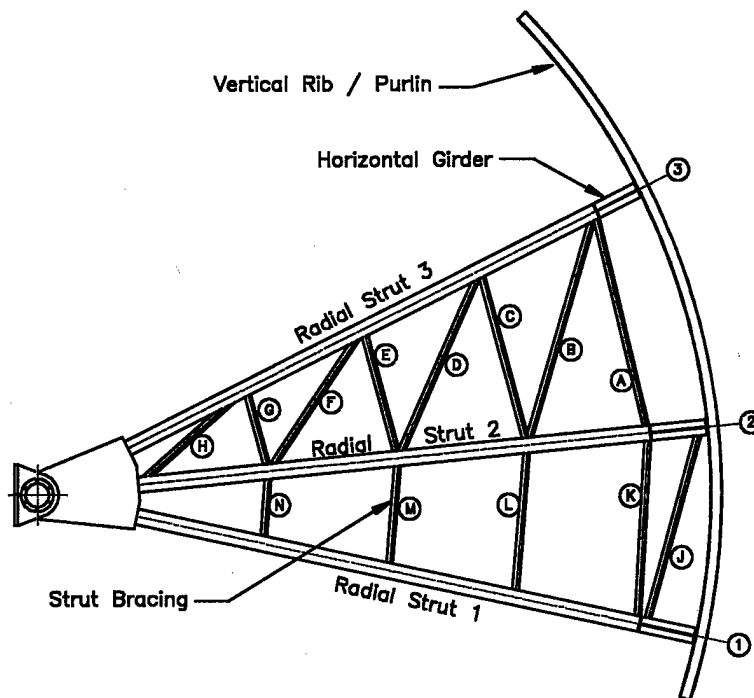


Figure 1: Radial gate member designations.

General Inspection Observations

The majority of condition observations found during the inspection are consistently found at all of the gates. The following section of the report pertains to those general observations or conditions which were found to apply to all of the gates. Specific observations or deficiencies for individual gates begin on page 22. No significant deviations from the as-built plans were observed for the radial gates. Field inspection sheets for the gates are included in Appendix A. Hoist operation and inspection sheets can be found in Appendix B.

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Upstream Surface of Skin Plate

The upstream surface of the skin plate is in extremely poor condition. There is large, scattered pitting on the entire surface of every gate. On average, the pits are approximately two inches in diameter and 1/4-inch to 5/16-inch deep. Many appear to be greater than 1/4-inch deep in the 3/8-inch thick portion of the skin plate and greater the 3/8-inch deep in the 1/2-inch thick portion. See Figure 2, and photos 4 through 7 below. The 3/4-inch thick cable wear plates are in good condition with respect to cable wear, however, there is pitting present in excess of 1/2-inch deep at some locations, see Photo. 8. At many locations the pitting on both the skin plate and wear plates appears to be associated with scratches or dings in the plates original protective coating. Based on the hemispherical shape of the pitting, the corrosion appears to be microbially influenced. It is likely that increased acid levels due to microbial activity have created a concentration cell within the pits and accelerated the corrosion.

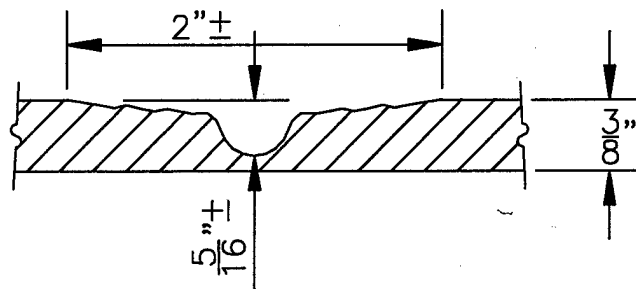


Figure 2: Typical pitting profile.



Photo. 4: Typical distribution of pitting.

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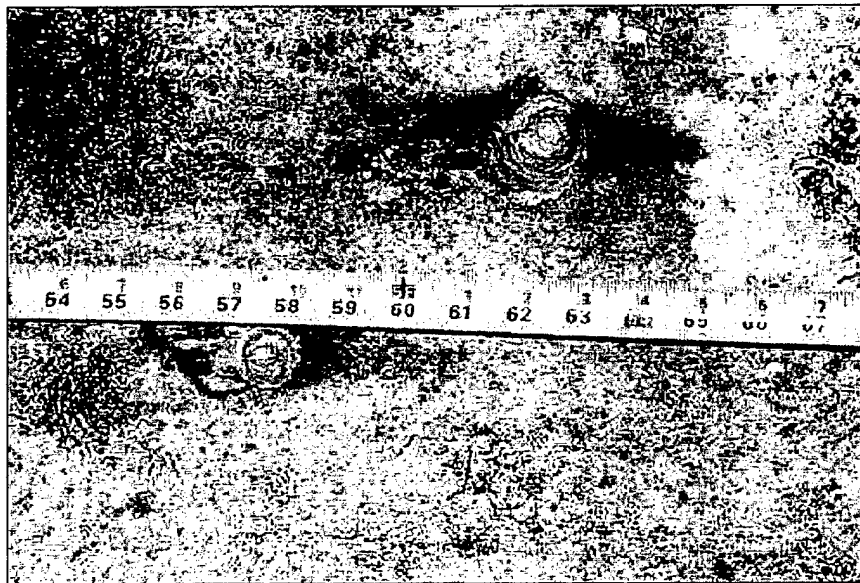


Photo. 5: Pitting, typical.

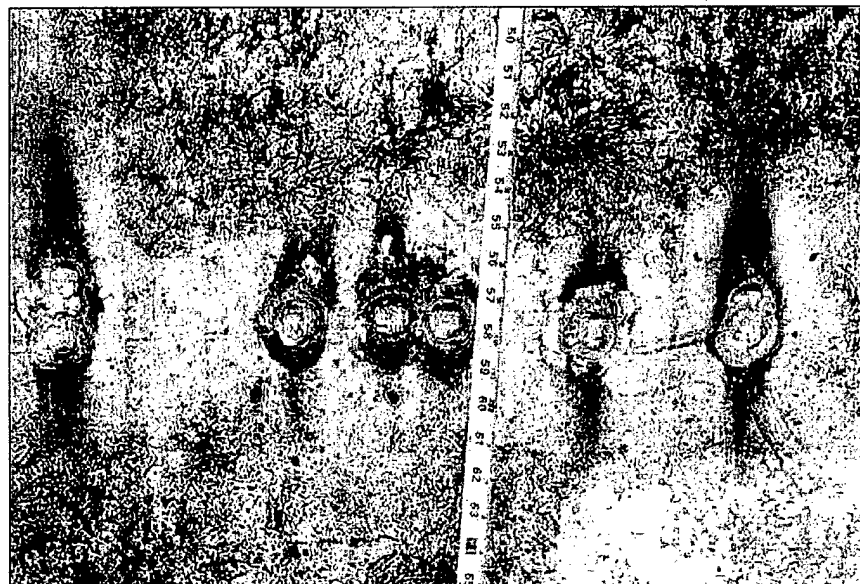


Photo. 6: Pitting, typical.

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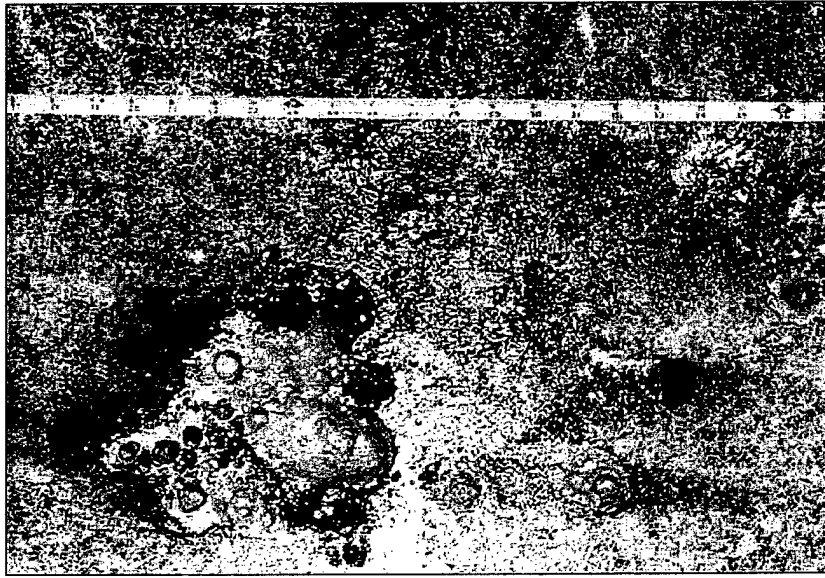


Photo. 7: Pitting, typical.



Photo. 8: Condition of cable wear plates, typical.

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Hoists Connections

The hoist connections are in generally good condition with light to moderate corrosion present on the lifting lug plates. The U-bolts, socket blocks and connection pin, which appear to be stainless steel, are in very good condition, see Photo. 9 . The design or material type for the U-bolts, socket blocks and connection pin are not listed in the available plans.

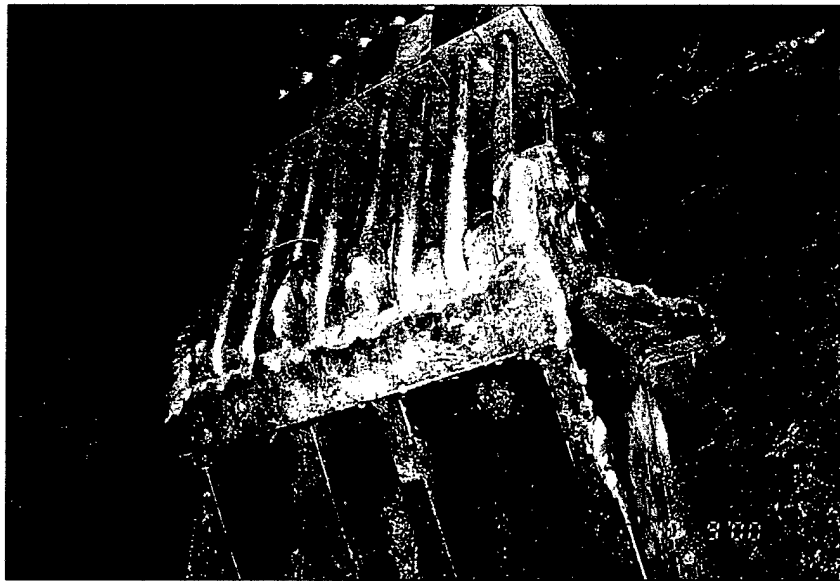


Photo. 9: Hoist connection, typical condition.

Downstream Surface of Skin Plate

The downstream surface of the skin plate is in generally good condition. Isolated spots of light surface corrosion and previous (painted over) pitting can be found at various locations.

Vertical Purlins

The vertical purlins are in generally good condition. At the bottom of the gate there is standing water between the bottom seal closure plate, the web of the purlins and the downstream side of the skin plate. Light to moderate corrosion is forming on all surfaces. There is no drainage for this space and it is consistently full of water and debris at all gates, see Figure 3 and Photo. 10.

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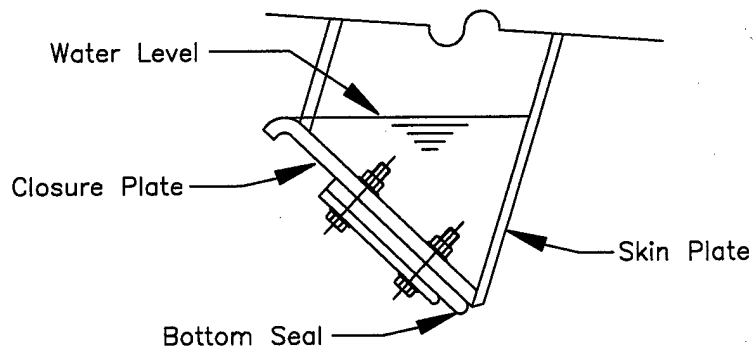


Figure 3: Standing water at bottom of gate between skin plate, purlin webs and bottom seal closure plate, typical.

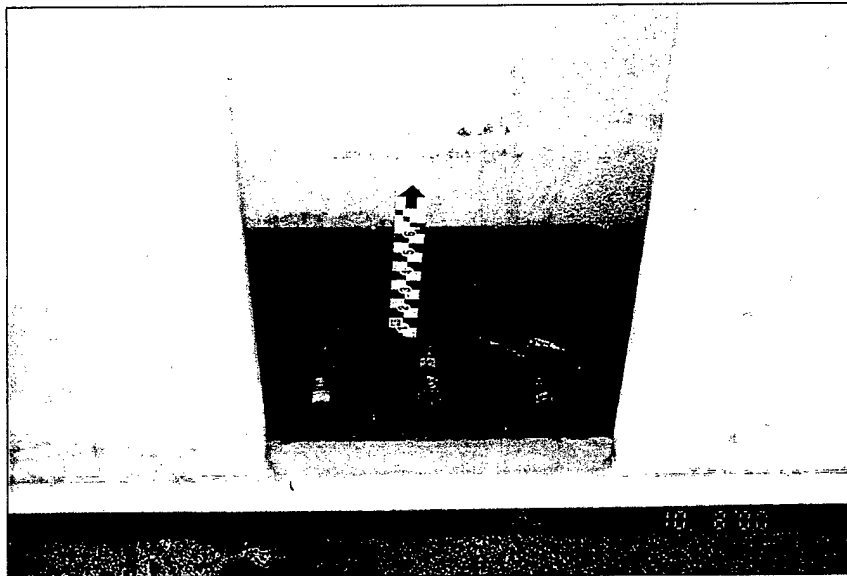


Photo. 10: Standing water at bottom of gate between skin plate, purlin webs and bottom seal closure plate, typical.

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Horizontal Girders and Braces

The horizontal girders and bracing are in generally good condition. There are isolated spots of light to moderate corrosion, mostly at locations with poor drainage.

The top and middle horizontal girders are divided into twelve drainage areas due to the web stiffeners. The area at either end of the girders is free to drain off the end of the web. The remaining ten areas have only three drain holes and require water to flow horizontally through at least one notch in the stiffeners in order to reach a drain hole. There are debris lines and evidence of standing water on nearly all of the horizontal girder flanges and webs.

The worst corrosion occurs on the bottom horizontal girder, between the multiple stiffeners, at each end of the girder. There are six stiffeners in close proximity to one another with drainage only provided horizontally through a notch at the upstream (low) end of the stiffener. In order for the last space to drain, the water must travel horizontally under five stiffeners. These notches are typically clogged and the area between the stiffeners is consistently full of water and debris, see Photo. 11.

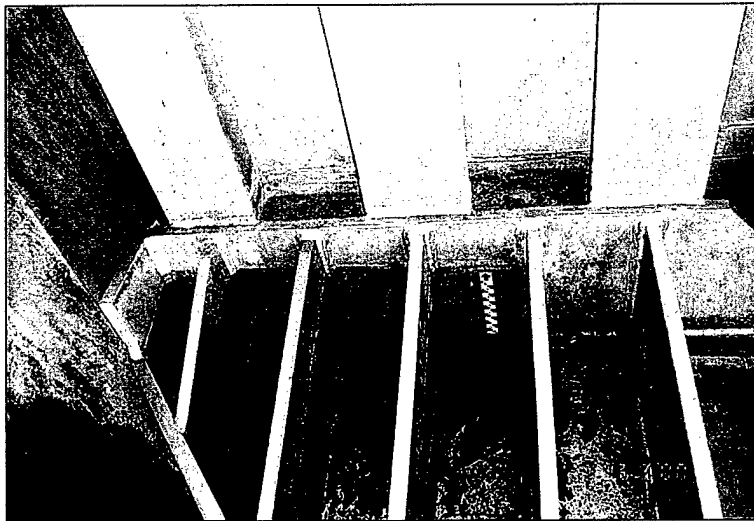


Photo. 11: Standing water between stiffeners at ends of bottom horizontal girder, typical.

Immediately upstream and slightly above the end of the bottom horizontal girders, there are stiffeners between the skin plate, purlins and upstream flange of the horizontal girders. There is no drainage from this location and the enclosed area is either full of water and/or debris on all gates. See Photo. 12.

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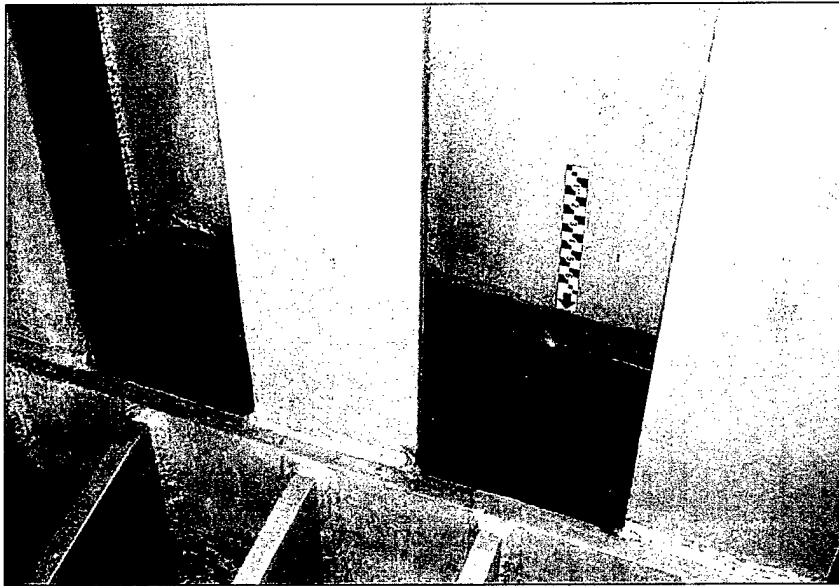


Photo. 12: Standing water and debris between purlins, skin plate and upstream horizontal girder flange, typical.

On the underside of the bottom horizontal girder, at the connection to the radial struts, there is delaminated paint and light to moderate corrosion around the drain hole in the girder web and near the adjacent stiffeners. See Photo. 13.



Photo. 13: Corrosion beneath bottom horizontal girder. Looking up at girder flange (behind hammer) and stiffener (right), typical.

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Radial Struts and Braces

The radial struts are in generally good condition with only light surface corrosion at isolated locations.

There is very poor drainage from the upstream end of the bottom radial strut and ponding or debris lines (evidence of previous ponding) are found at every gate, see Photo. 14.

There is very poor drainage from the downstream end of the top radial strut at the trunnion. The three radial struts become an enclosed box section at the trunnion. Since there is no drainage vertically from between the flanges of the top strut, a small drain hole is provided horizontally through the strut flange. The drain hole is consistently clogged and standing water is present at most trunnions.

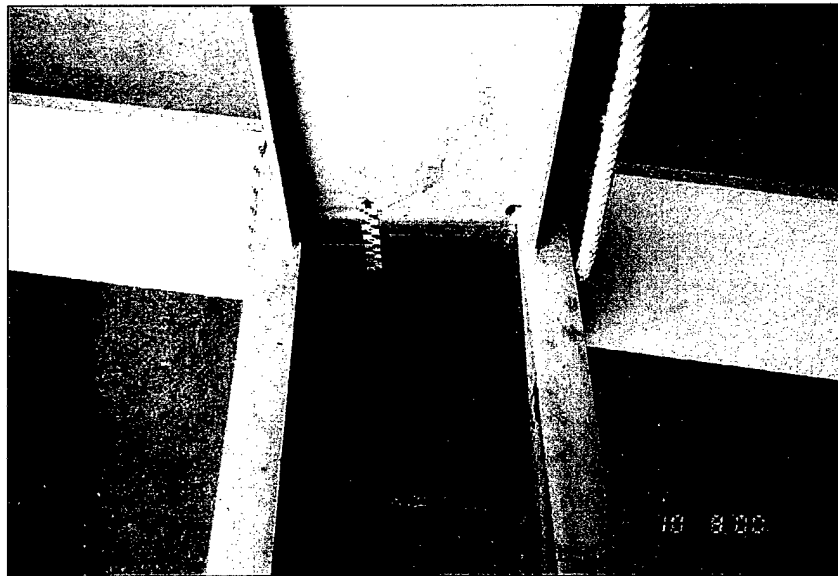


Photo. 14: Standing water at upstream end of bottom radial strut, typical.

Trunnions

The trunnion hubs, yokes and bearing material are in generally very good condition and appear well lubricated. Lubricant was observed being expelled between the yoke and hub, around the circumference of all of the trunnions.

Side and Bottom Seals

The side and bottom seals are in generally good condition. Small side and bottom seal leaks are visible on many of the gates, although no major leaks were observed. There is a leak at the bottom seal, at the spillway monolith construction joint at nearly every gate. Photo. 15. The

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bottom and side seal material is in good condition with very little cracking or deterioration present.



Photo. 15: Leak at spillway monolith construction joint, typical.

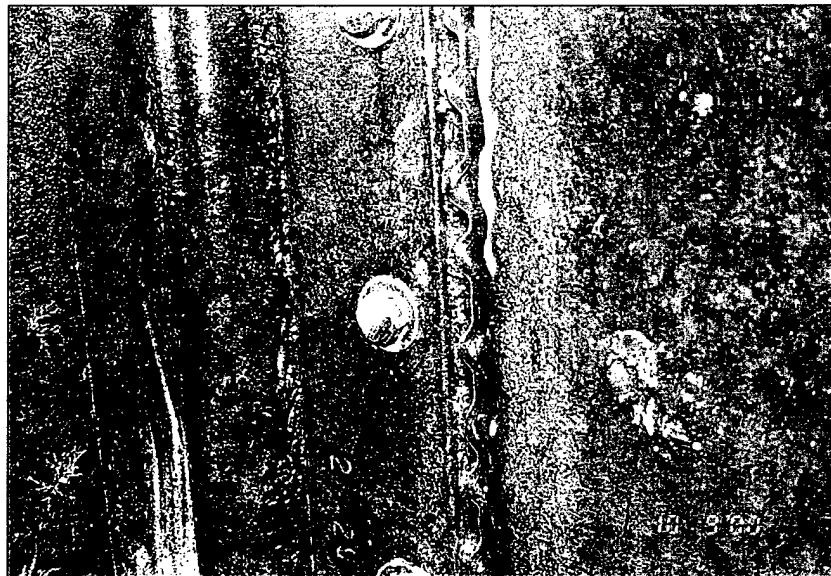


Photo. 16: Side seal from upstream side with no signs of cracking or deterioration, typical.

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There is moderate corrosion on the skin plate on the upstream side of the bottom seal. The downstream side of the bottom seal is in good condition with little occurrence of corrosion. See Photo. 17 and Photo. 18.

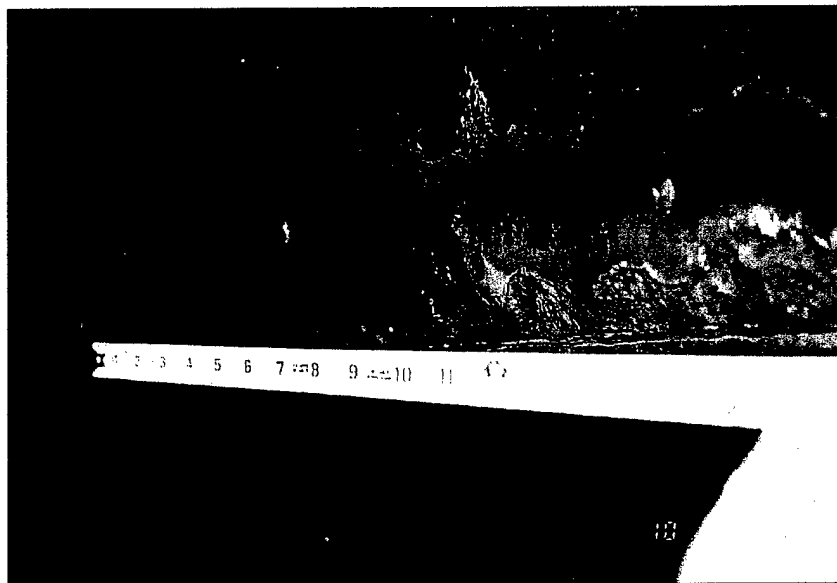


Photo. 17: Upstream side of bottom seal with light to moderate corrosion on skin plate, typical.

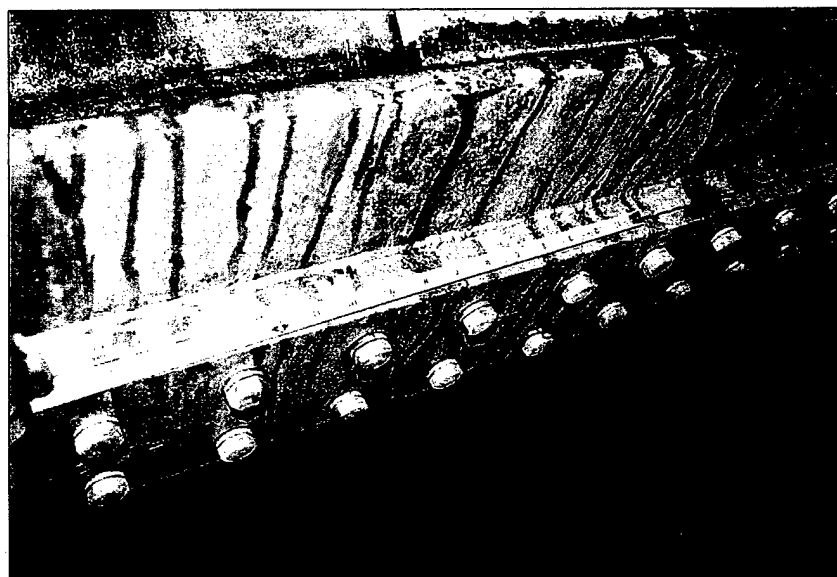


Photo. 18: Downstream side of bottom seal, typical

Radial Gate – Operation, Testing and Measurements

Member Section Dimensions

Section dimensions of main structural members were measured to verify conformance with the design drawings. These members included radial struts, radial strut bracing, horizontal girders, horizontal girder bracing and purlins. Measured dimensions were recorded on field data sheets found in Appendix A. The data sheets also contain nominal section dimensions from the American Institute of Steel Construction (AISC) *Steel Construction Manual, Seventh Edition, 1970*. Section measurements typically include the depth, d (measured at the edges of the flanges), the flange width, b_f , and the flange thickness, t_f . Web thickness, t_w , was only measured if there was an exposed portion of the web or drain holes large enough for calipers.

Differences between the design drawings and the actual field conditions of 1/16th inch or less were deemed to be insignificant. Nearly all members in the field were found to be greater or equal in dimension than what was required in the design drawings. The larger dimensions were probably due to inaccuracies of the field measurements resulting from difficult access or with the thickness of the paint on the members. Those that were smaller were all within the fabrication tolerances. Of those measurements that were out of fabrication tolerance range, none were consistently out of range to conclude that a member other than what was specified in the design drawings was used.

Racking Measurements

Racking measurements for the gates were made at the beginning of the upstream inspection of the gates. Measurements were recorded for the distance between the bottom of the gate at the bottom corner of the bottom seal plate, and the embedded spillway plate. Measurements were made as far as possible to the left and right side of the gate depending on stoplog leakage and flow on the spillway. The gates were typically between two and three feet open when the measurements were made. The measurements for racking are as follows:

	Left (inches)	Right (inches)
Gate 1	-	-
Gate 2	35 - 3/4	36 - 1/2
Gate 3	47	47
Gate 4	14 - 1/2	14 - 3/4
Gate 5	24 - 3/4	24 - 3/4
Gate 6	30 - 1/4	30 - 1/4
Gate 7	24 - 3/4	24 - 3/4
Gate 8	26	25 - 3/8

Table 2: Gate racking measurements.

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The gates were also observed at the moment of first opening to look for signs of water release beginning from one side of the gate or the other. In most cases, water release would begin at both sides of the gate simultaneously and move towards the middle of the gate at equal rates. Based on the recorded measurements and observations, there is no apparent racking of the gates.

Trunnion Hub Movement: Closed - Full Open - Closed

With the stoplogs in place, measurements were made of the transverse gap between the trunnion hub and the trunnion yoke at both trunnions. The measurements were made with the gate at the initial opening, full open, and again when closed. The maximum transverse movement recorded between any two positions is as follows:

	Left Trunnion		Right Trunnion	
	Inside (inches)	Pier Side (inches)	Inside (inches)	Pier Side (inches)
Gate 1	0	0	0	0
Gate 2	1/32	0	1/32	0
Gate 3	0	0	0	0
Gate 4	0	0	0	0
Gate 5	1/16	0	0	0
Gate 6	0	0	1/32	0
Gate 7	0	0	0	0
Gate 8	0	0	0	0

Table 3: Transverse trunnion hub movement through full opening and closing

Based on the surface irregularities of the trunnion hub and the casting tolerances, the transverse measurements between the hub and the yoke can only be considered accurate to $\pm 1/16$ -inch. The recorded measurements indicate there is no appreciable lateral movement of the trunnion hubs with respect to the trunnion yoke during either opening or closing of the gate.

LOWER GRANITE DAM

Trunnion Hub Movement: Unloaded vs. Loaded

Dial gages were installed at one trunnion to record the vertical, transverse and upstream / downstream movement of the trunnion hub with respect to the trunnion yoke. The initial measurement was made with the stoplogs in place and no load on the gate. The final reading was made after the top stoplog was removed and the gate was fully loaded. The maximum movements recorded at the trunnion hubs are as follows:

	Vertical (1 / 1000 inch)	Upstream / Downstream (1 / 1000 inch)	Transverse (1 / 1000 inch)
Gate 1	4	25	0
Gate 2	2	39	33
Gate 3	4	29	10
Gate 4	2	33	0
Gate 5	16	54	18
Gate 6	9	36	6
Gate 7	6	35	2
Gate 8	3	25	9

Table 4: Loaded versus unloaded trunnion movements

For the vertical movements shown in Table 4, the hub moved upward with respect to the yoke during loading. The upstream / downstream movement of the hub was in the downstream direction and the transverse movement was outward, toward the piers.

The tolerance for the 24-inch diameter trunnion pin is listed in the design plans as +0.000 inches and -0.005 inches. The tolerances for the 24-inch diameter trunnion bushing is listed as +0.012 inches and -0.000 inches. The shop plans for the pin indicate the pin should be 23.980 inches in diameter with tolerances of +0.000 inches and -0.008 inches.

Based on the tolerances listed either in the design plans or the shop plans, there is no significant displacements of the trunnion hub with respect to the trunnion yoke occurring during the loading or opening process.

LOWER GRANITE DAM

Individual Gate Inspection Observations

The observations in the following section pertain only to the gates indicated and were not typically found on all of the gates.

Gate 1

- Due to the presence of the surface collector installed in the stoplog slots at Gate 1, the upstream inspection and operational tests were not performed until November 20th, see Photo. 19. The upstream surface of the skin plate was in generally the same condition as the previously inspected gates.

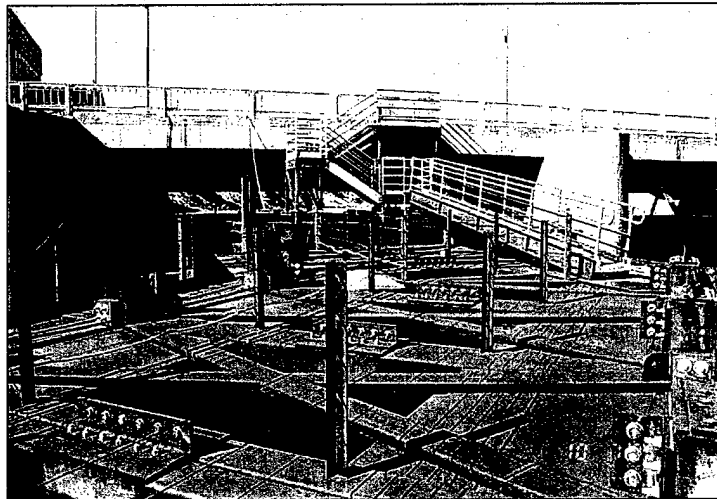


Photo. 19: Surface collector installed at Gate 1 during initial inspection.

LOWER GRANITE DAM

Gate 2

- Flange and web at the top left vertical brace at connection to middle girder is deformed. The web is deformed toward the middle of the gate approximately 1 inch. See Photo. 20 and Photo. 21.

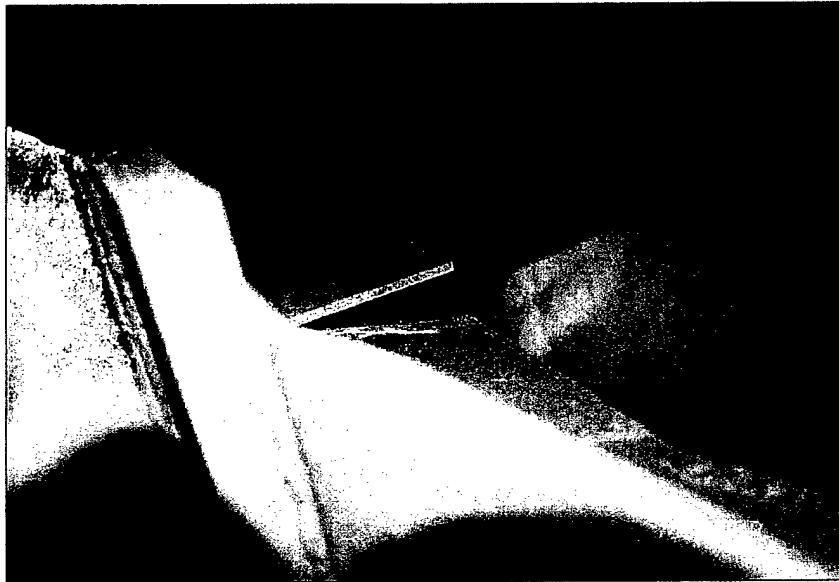


Photo. 20: 1 inch deflection in web of top left vertical brace at middle girder.



Photo. 21: 1/4 inch deflection in flange of top left vertical brace middle girder.

LOWER GRANITE DAM

Gate 3

- At the upstream end of the bottom right radial strut there are indentations on the outside surface of the inside (spillway side) flange. The indentations appear to be due to previous grinding which occurred prior to the most recent painting. See Photo. 22

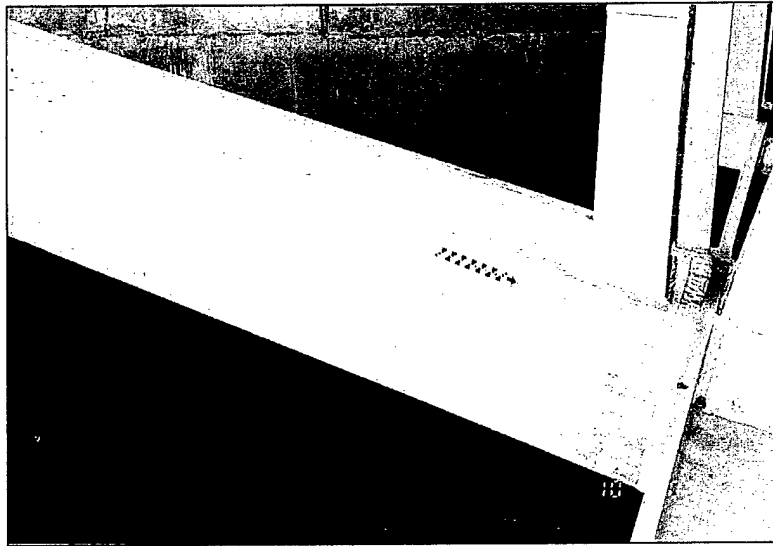


Photo. 22: Grinding marks on lower strut flange.

- There appears to be a small lubrication leak in the lubrication line to the right (looking downstream trunnion). There is a bulge of lubricant at the angle coupling between the flexible line and the trunnion hub. See Photo. 23.



Photo. 23: Lubricant bulb at connection to trunnion.

LOWER GRANITE DAM

Gate 4

- Prior to the inspection of the upstream face of the gate and waterblasting, an approximately 10-inch diameter paint blister was observed on the downstream side of the skin plate. The blister was located between the middle and top horizontal girders, approximately 7-feet from the left side of the gate (looking downstream) and approximately 6-feet above the transition between the 1/2-inch and 3/8-inch skin plate. The blister did not appear to be leaking water at the time, however, rust stains were observed on and beneath the blister. After waterblasting the upstream surface of the gate, the blister developed several leaks, see Photo. 24 and Photo 25. During the downstream inspection of the gate the blistered paint was removed to expose the hole in the skin plate, see Photo 26. The actual hole through the skin plate was roughly oblong and approximately 1/4-inch wide and 1/8-inch tall.
- The leak was patched by Gus Hernandez, USACE, on October 17th using META-LOX™ Industrial-Grade Metallic Patching Compound, a 2-part epoxy and resin compound.

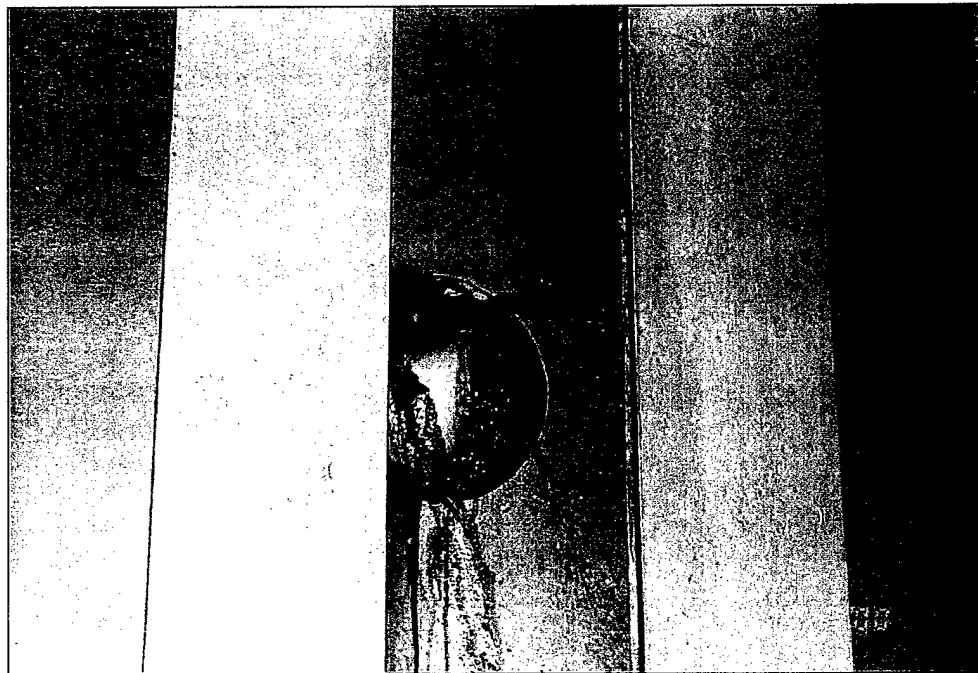


Photo. 24: Paint blister and leakage downstream side of skin plate, prior to removal of paint.

LOWER GRANITE DAM



***Photo. 25: Skin plate leak
prior to removal of
paint.***



***Photo. 26: Skin plate leak
after removal of
paint.***

LOWER GRANITE DAM

Gate 5

- There is a indentation in radial strut brace H on the right side frame. The indentation is approximately 2 inches long, ½ inch wide, and ¼ inch deep. The indentation appears old and probably occurred during construction. There is no sign of distress or corrosion associated with it, see Photo. 27.

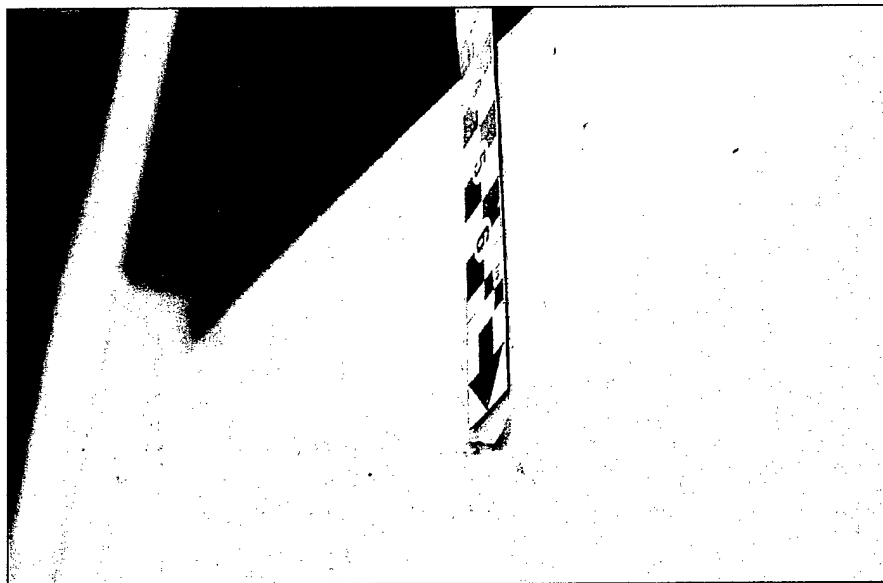


Photo. 27: Deformation in Brace H.

Gate 6

- See general condition observations.

LOWER GRANITE DAM

Gate 7

- The web of the top right vertical bracing at connection to middle girder is deformed. The web is deformed towards the middle of the gate approximately 2 inches. This is similar to deformation on Gate 2. See Photo. 28.

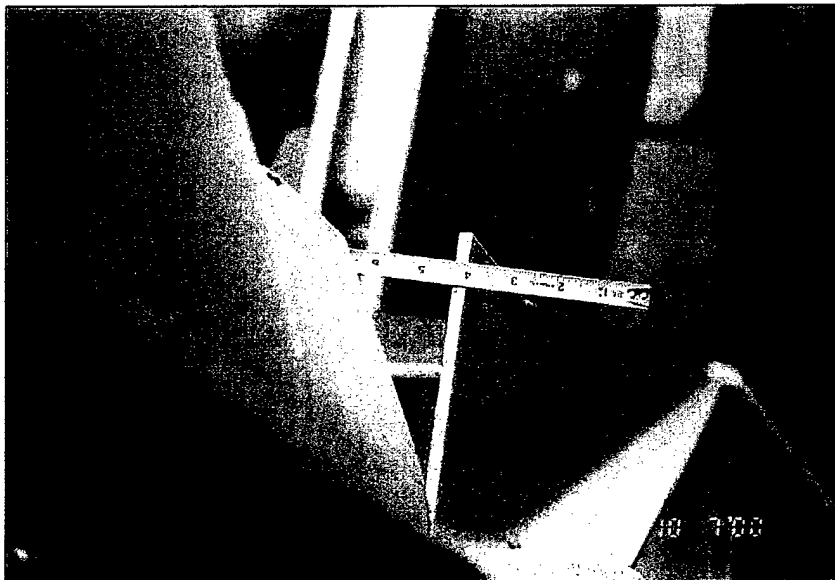


Photo. 28: 2 inch deflection in top right vertical bracing at middle girder.

Gate 8

- See general condition observations.

Ultrasonic Testing Results

Description

The field welds on the gates were tested ultrasonically to determine the amount of discontinuity present and the integrity of the welds. The location of the tested welds is shown in Figure 4.

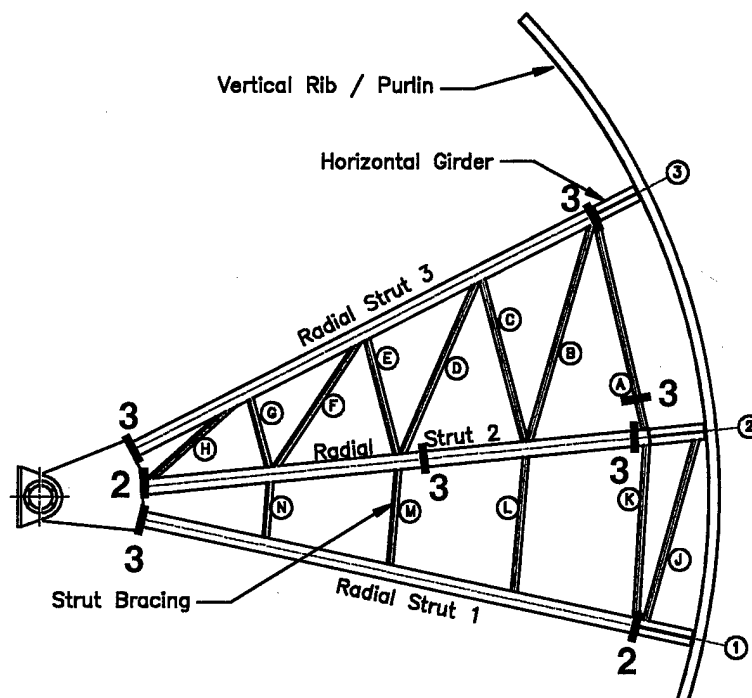


Figure 4: Ultrasonic Weld Test Locations.

A total of 352 welds were tested, of which 54 welds were rejected in accordance with the requirements of ANSI / AASHTO / AWS D1.5, 1995 Bridge Welding Code. Of the welds which failed the testing, 69% were located at the upstream end of the radial struts. Only one weld at the connection between the downstream end of the radial struts and the trunnions was found to fail the testing.

Table 5 lists the rejected welds by gate number and location on the gate. The letter 'f' indicates a flange weld, 'w' a web weld. Approximately 75% of the rejected welds were located on the flanges of the members. Figure 5 illustrates the percentage of welds which failed testing and the total number of welds which failed for each location tested.

The extent and depth of the rejected welds are marked on each of the tested welds in the field. At each rejected weld there will be a start and end mark along the weld and a number indicating the depth of the flaw. For individual gate weld test sheets, see Appendix C.

LOWER GRANITE DAM

Gate	Welds Accepted	Welds Rejected	Flaw Severity Class				Locations
			A	B	C	D	
1	41	3	1	2	0	0	33w, 34f, 35f
2	42	2	2	0	0	0	58fo, 59fo
3	37	7	6	1	0	0	25f, 26f, 27f, 28f, 29f, 30f, 31w
4	27	17	12	2	0	3	36w, 37fo, 38fi, 39fi, 40fi, 42fo, 43w, 44fi, 45w, 36fo, 47fi, 48w, 49fo, 50fo,
5	41	3	3	0	0	0	78fi, 79fi, 80fi
6	41	3	2	1	0	0	60fo, 61fo, 62fi
7	29	15	15	0	0	0	63fo, 64fo, 65fi, 66w, 67fi, 68fi, 69w, 70fo, 71fi, 72fo, 73fi, 74w, 75fo, 76w,
8	40	4	4	0	0	0	54, 55w, 56fi, 57w

Table 5: Ultrasonic Testing Summary.

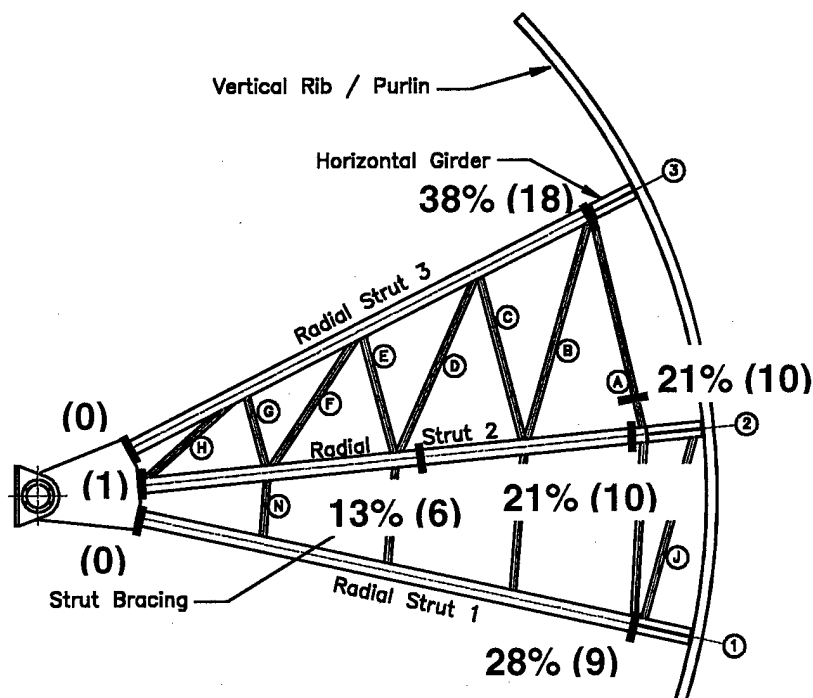


Figure 5: Ultrasonic Weld Test Locations and Percentage of Welds Failing Testing at Each Location.

Hoists – Operation, Testing and Measurements

Hoist Operation Inspection

External portions of the hoist equipment, support platforms and gate connections were visually inspected for signs of excessive corrosion, wear or damage. See Photos 29, 30 and 31 below. The hoist and hoist machinery are in generally good condition.

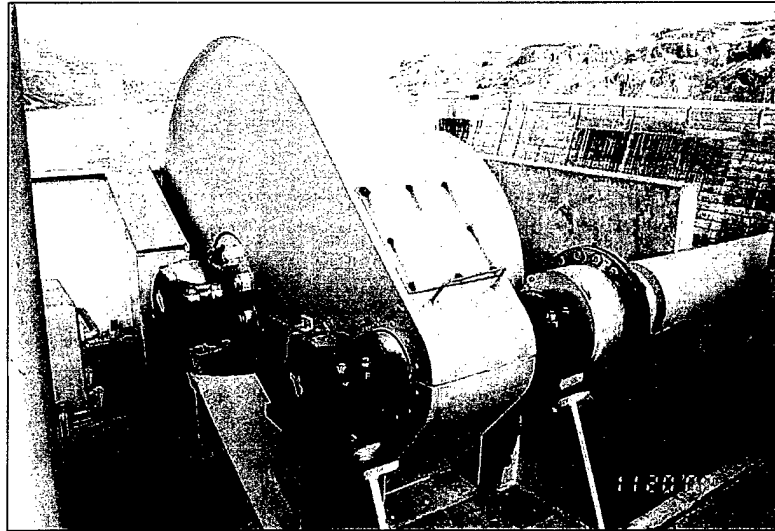


Photo. 29: Hoist, typical.

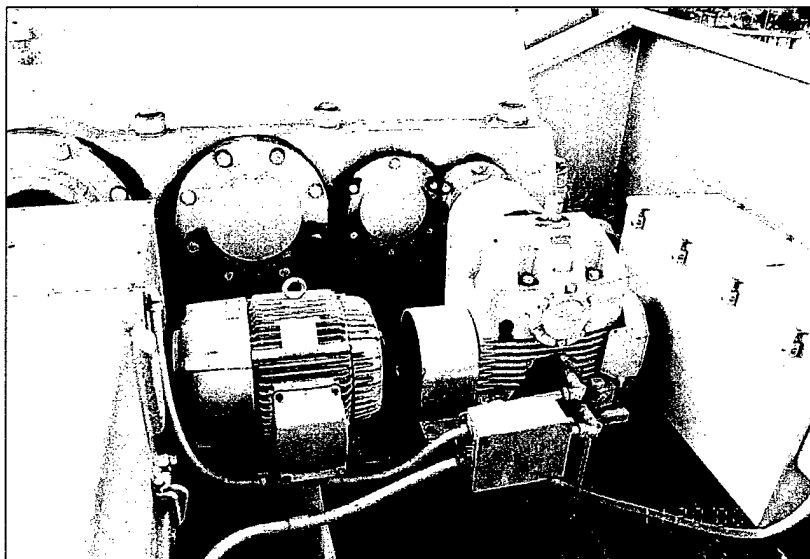


Photo. 30: Hoist motors, typical.

LOWER GRANITE DAM



Photo 31: Hoist manufactures plate, typical.

The following observations were made at individual gate hoists:

	Hoist and Motor Observations
Gate 1	Loaded test only performed due to surface collector.
Gate 2	There is a high level of noise from the right angle gearbox. The coupling should be checked and lubricated.
Gate 3	Right angle gearbox - high level of noise -check coupling and lube. Main gearbox has severe oil leak at output shaft.
Gate 4	There is bearing noise at the motor output shaft. The main gearbox shaft seals are weeping.
Gate 5	The main gearbox output shaft seals are leaking.
Gate 6	The main gearbox seals are weeping.
Gate 7	The main gearbox seals are weeping.
Gate 8	The main gearbox seals are weeping.

Table 6: Hoist operation observations.

LOWER GRANITE DAM

Hoist Amperage Measurements:

Hoist amperage readings were recorded during opening and closing of the gates in both the loaded and unloaded condition. The readings include the start up and running amperage.

Running amperages were recorded for Phase A, B and C. Table 7 lists the opening and closing start up amperage and the average of the three phases for the running amperage for the gates in the unloaded condition. Table 8 lists the same information for the loaded condition.

	Start up Opening	Start up Closing	Running Opening	Running Closing
Gate 1	No unloaded test performed due to surface collector			
Gate 2	106.0	102.0	13.5	9.0
Gate 3	114.4	111.2	15.6	10.6
Gate 4	112.0	105.0	15.9	10.2
Gate 5	115.0	111.2	14.5	10.2
Gate 6	110.5	110.0	15.5	9.9
Gate 7	124.1	110.0	15.8	9.4
Gate 8	110.4	110.6	15.3	10.3

Table 7: Unloaded Gate - Hoist Amperage Readings

	Start up Opening	Start up Closing	Running Opening	Running Closing
Gate 1	112.0	110.0	16.0	9.4
Gate 2	108.0	104.5	15.3	9.9
Gate 3	117.6	114.4	16.3	10.1
Gate 4	116.2	104.8	15.7	9.6
Gate 5	108.8	112.0	15.9	10.1
Gate 6	113.6	106.4	15.7	10.2
Gate 7	116.8	110.8	15.5	9.9
Gate 8	114.0	108.0	15.7	10.0

Table 8: Loaded Gate - Hoist Amperage Readings

Based on the consistency of the readings the hoists are in generally good condition. The amperage data indicates that the tainter gate hoist motors are operating well within their design operating limits that normally allow the starting amperage to be in the range of 5 to 8 times the nameplate value. The current draw for all motors were in acceptable range and the gates appeared to be free with no apparent binding. The field inspection sheets for the hoist measurements can be found in Appendix B.

RECOMMENDATIONS

Recommended in the next year or as necessary:

- Repair pitting on skin plate and repaint (or recoat) upstream surface of gate face.
- Install sacrificial anodes on upstream side of gate. Based on the condition of the skin plate at Little Goose Dam (which has sacrificial anodes) sacrificial anodes will significantly reduce the amount and severity of pitting of the skin plate. A corrosion expert should be consulted to determine the number and location of anodes required.

These repairs can be undertaken sequentially on all of the gates at once or the repairs could be made on an as-needed basis as the pitting penetrates the skin plate and leaks develop at individual gates.

Recommended in the next 2 years:

- Perform a structural analysis of the gates to determine capacity for trunnion friction, operating loads and the demand on the welded joints which were found to contain flaws.
- Analyze the hoist gearboxes per the manufactures recommendation and remanufacture or replace as required.
- Replace the main gearbox seals on the hoist motors.

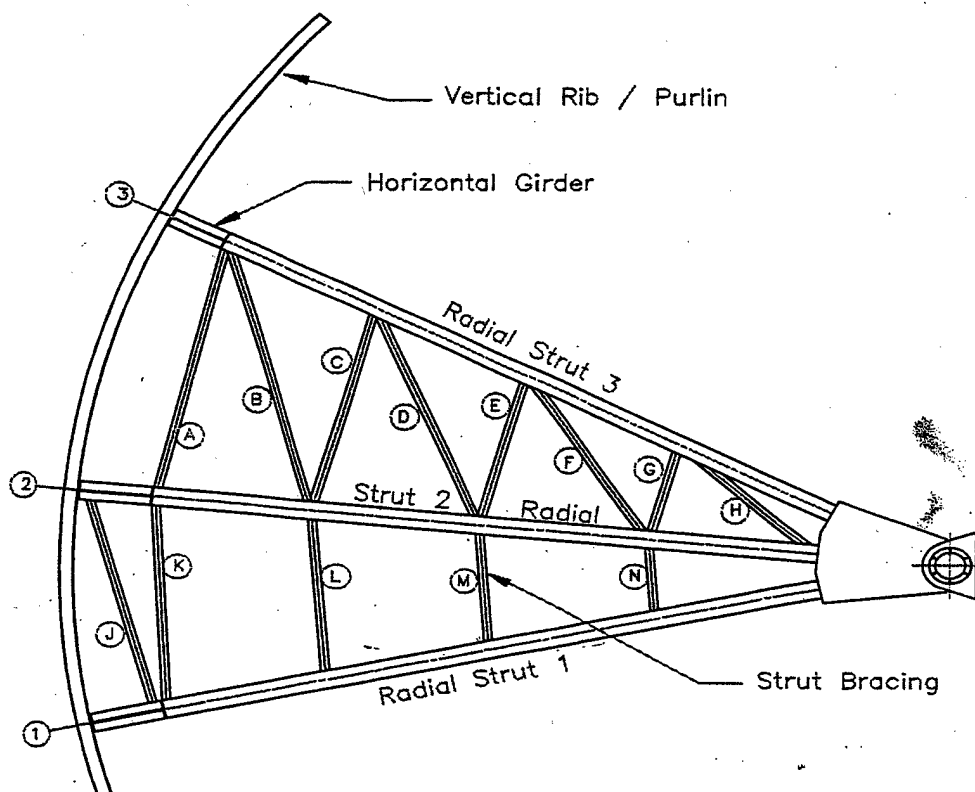
Recommended in the next 5 years:

- Install drain hole between the multiple stiffeners at ends of the bottom horizontal girders. The recommended size for these drain holes is 1-inch in diameter.
- Install drain holes in the purlin stiffeners near the ends of the bottom horizontal girders (Plate perpendicular to skin plate, above multiple stiffeners on bottom horizontal girder). The recommended size for these drain holes is 1-inch in diameter.
- Install drain holes in the downstream portion of the bottom seal plate between every purlin. Note: the rubber bottom seal is located between the bottom seal plate and the bottom seal keeper plate. The hole should not be flame cut with the rubber bottom seal in place. The recommended size for these drain holes is 1-inch in diameter.
- Enlarge the drain holes at upstream end of lower radial struts. The recommended size for these drain holes is 1 1/2 - inch in diameter.
- For all new and enlarged drain holes, the holes should be drilled, not flame cut, to reduce jagged edges which snag debris. If drilling holes is not feasible, then the edges of the flame cut holes should be reamed smooth.

REFERENCES

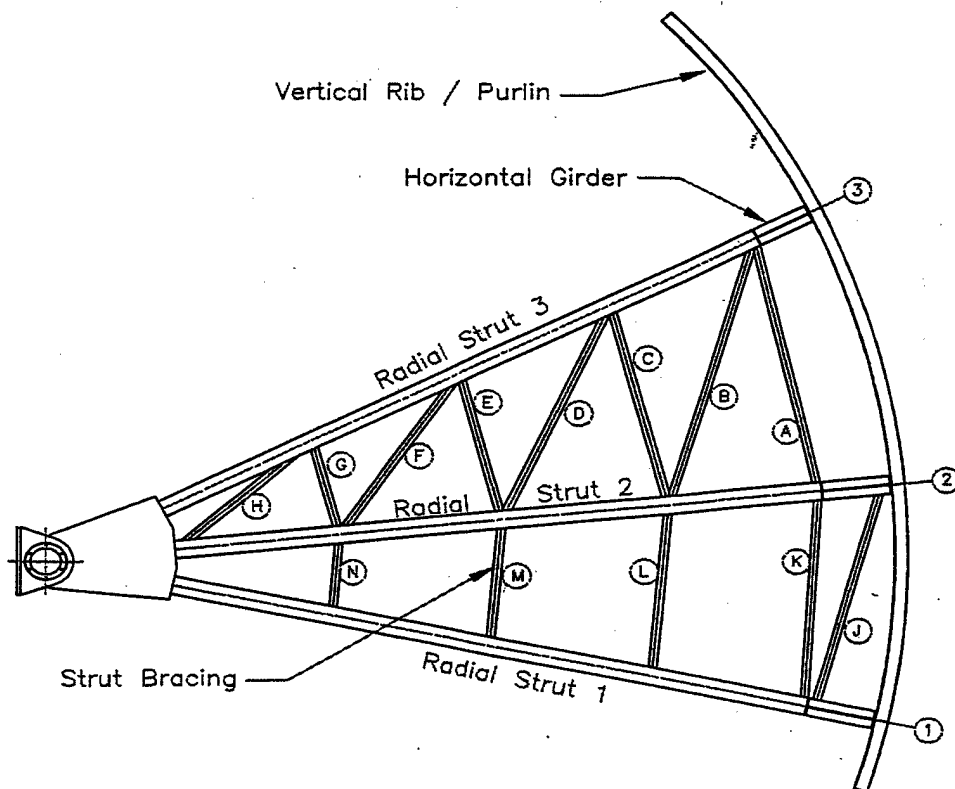
1. Water Control Manual, Lower Granite Lock and Dam, U.S. Army Corps of Engineers, Walla Walla District, May 1987.
2. Lower Granite Lock and Dam, Operations Manual, SCM Consultants , Inc.

Gate No. 1
Left Elevation B-B



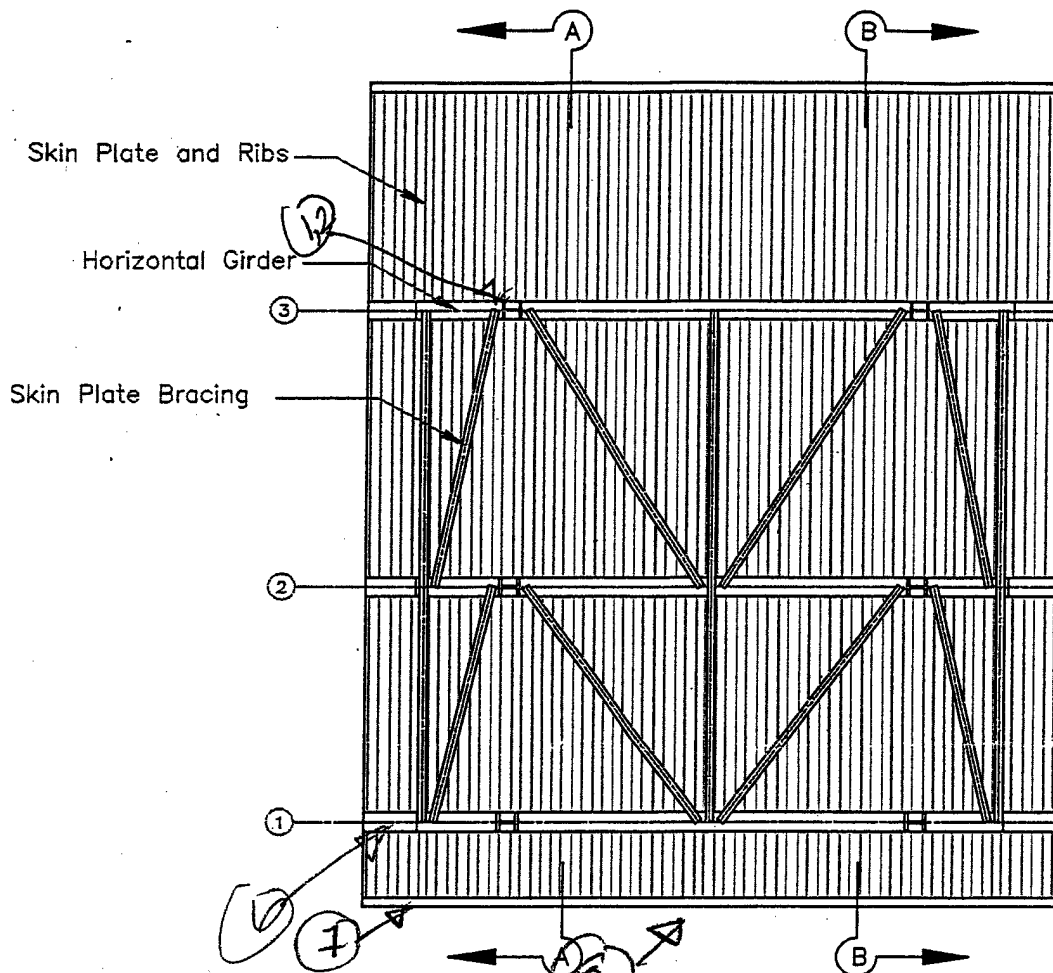
Member	Type	Depth d		Web t _w		Flange(s)			
		Plan (in)	Measured (in)	Plan (in)	Measured (in)	Plan (in)	Measured (in)	Plan (in)	Measured (in)
Strut 3	14 WF 202	15 5/8		15/16		15 3/4	✓	1 1/2	✓
Strut 2	14 WF 342	17 1/2	17 3/4	1 9/16		16 3/8	✓	2 7/16	✓
Strut 1	14 WF 398	18 1/4		1 13/16		16 5/8		2 13/16	
Brace A	14 WF 30	13 7/8	13 3/4	5/16		6 3/4	✓	3/8	✓
Brace B	14 WF 30	13 7/8	✓	5/16		6 3/4	✓	3/8	✓
Brace C	14 WF 30	13 7/8	13 3/4	5/16		6 3/4	✓	3/8	✓
Brace D	14 WF 30	13 7/8	13 7/8	5/16		6 3/4	✓	3/8	✓
Brace E	14 WF 30	13 7/8	14	5/16		6 3/4	✓	3/8	✓
Brace F	14 WF 30	13 7/8	14	5/16		6 3/4	✓	3/8	✓
Brace G	14 WF 30	13 7/8	✓	5/16		6 3/4	✓	3/8	✓
Brace H	14 WF 30	13 7/8	14 3/16	5/16		6 3/4	✓	3/8	✓
Brace J	14 WF 30	13 7/8	✓	5/16		6 3/4	✓	3/8	✓
Brace K	14 WF 30	13 7/8	13 3/4	5/16		6 3/4	✓	3/8	✓
Brace L	14 WF 30	13 7/8	14	5/16		6 3/4	✓	3/8	✓
Brace M	14 WF 30	13 7/8	14	5/16		6 3/4	✓	3/8	✓
Brace N	14 WF 30	13 7/8	14	5/16		6 3/4	✓	3/8	✓

Gate No. 1
Right Elevation A-A



Member	Type	Depth d		Web t _w		Flange(s)			
		Plan (in)	Measured (in)	Plan (in)	Measured (in)	Plan (in)	Measured (in)	Plan (in)	Measured (in)
Strut 3	14 WF 202	15 5/8	15 3/8	15/16	—	15 3/4	15 3/4	1 1/2	1 1/2
Strut 2	14 WF 342	17 1/2	17 1/2	1 9/16	—	16 3/8	16 3/8	2 7/16	2 1/2
Strut 1	14 WF 398	18 1/4	18 1/4	1 13/16	—	16 5/8	16 5/8	2 13/16	2 7/8
Brace A	14 WF 30	13 7/8	14	5/16	—	6 3/4	6 3/4	3/8	3/8
Brace B	14 WF 30	13 7/8	14	5/16	—	6 3/4	6 3/4	3/8	3/8
Brace C	14 WF 30	13 7/8	14	5/16	—	6 3/4	6 3/4	3/8	3/8
Brace D	14 WF 30	13 7/8	13 3/4	5/16	—	6 3/4	6 3/4	3/8	3/8
Brace E	14 WF 30	13 7/8	14 1/8	5/16	—	6 3/4	6 3/4	3/8	3/8
Brace F	14 WF 30	13 7/8	14	5/16	—	6 3/4	6 3/4	3/8	3/8
Brace G	14 WF 30	13 7/8	14	5/16	—	6 3/4	6 3/4	3/8	3/8
Brace H	14 WF 30	13 7/8	14 1/8	5/16	—	6 3/4	6 3/4	3/8	3/8
Brace J	14 WF 30	13 7/8	14	5/16	—	6 3/4	6 3/4	3/8	3/8
Brace K	14 WF 30	13 7/8	14	5/16	—	6 3/4	6 3/4	3/8	3/8
Brace L	14 WF 30	13 7/8	14	5/16	—	6 3/4	6 3/4	3/8	3/8
Brace M	14 WF 30	13 7/8	14	5/16	—	6 3/4	6 3/4	3/8	3/8
Brace N	14 WF 30	13 7/8	14	5/16	—	6 3/4	6 3/4	3/8	3/8

Gate No. 1 Downstream Elevation



① leaking Gate @ Bottom ②

Member	Type	Depth		Web		Flange - End			
		Plan (in)	Measured (in)	Plan (in)	Measured (in)	Plan (in)	Measured (in)	Plan (in)	Measured (in)
Horiz. Girder 3	PL Girder	49 3/4	✓	7/16	✓	16	✓	7/8	✓
Horiz. Girder 2	PL Girder	60 1/2	✓	3/4	5/8	16 1/2	✓	1 1/4	✓
Horiz. Girder 1	PL Girder	60 1/2	✓	1	✓	16 1/2	✓	1 1/4	✓
Purlins	ST 10 WF 31	10 1/2	✓	13/32	✓	8 1/4	✓	5/8	✓
Skin PL Bracing	ST 7 WF 15	7	10 7/8	1/4	✓	6 3/4	✓	3/8	✓

① Corrosion due to standing water

② Corrosion between splice plates due to water

③ Leak in 1. side seal

④ Corrosion in 2nd Girder

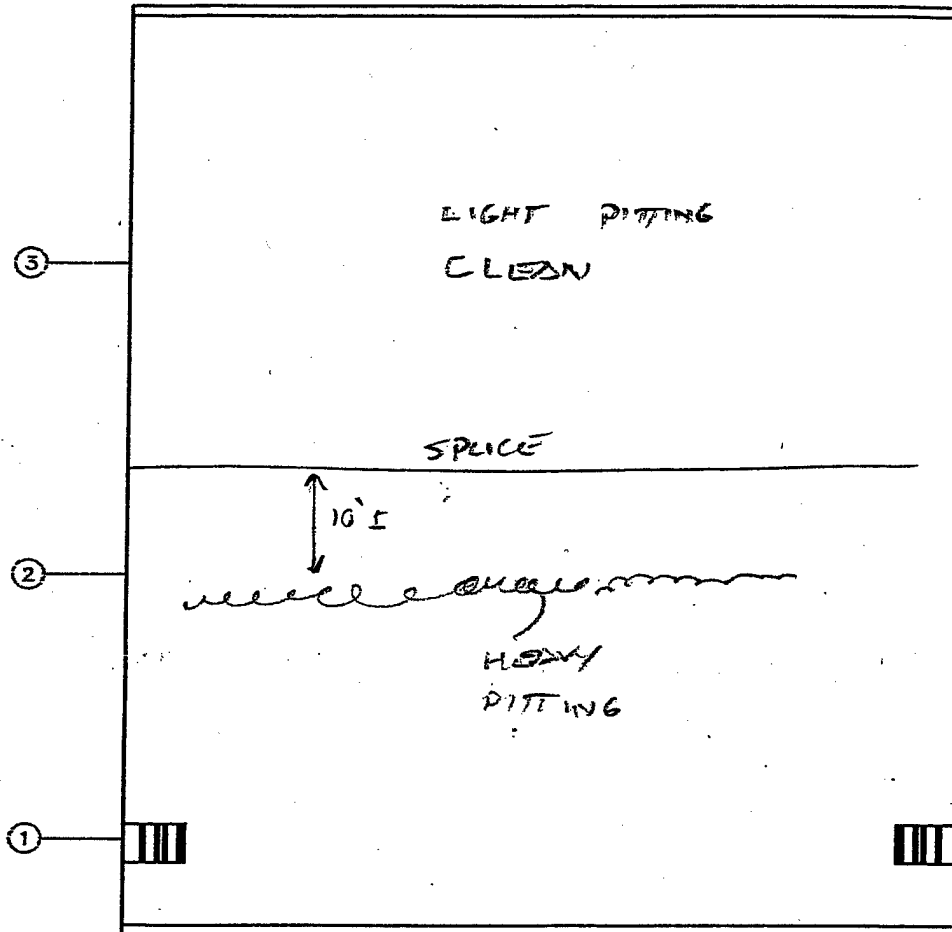
⑤ Ponding water on bottom strut to bottom girder

⑥ Bottom Girder, left

⑦ Standing Water @ Purlins

⑧ Center @ Gate Missing concrete at Bottom Plate

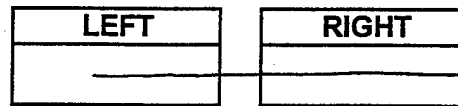
Gate No. 1 Upstream Elevation



HEAVY PITTING @ 10' BELOW SPICE / TOP OF OTHER GATES

Gate No. 1 Operation and Trunnion Measurements

Racking Measurements: Bottom of Gate and Spillway



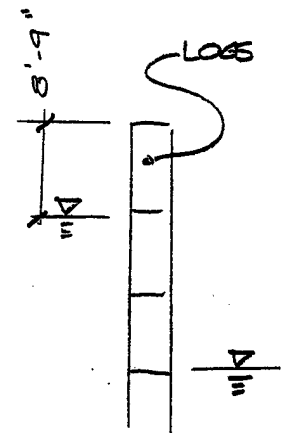
TOO MUCH LEAK
AND FLOW FROM
STOPLOGS TO
MEASURE

Transverse Trunnion Hub Movement, No Load on Gate: Closed-Open-Closed

	LEFT		RIGHT	
	Inside	Outside (pier)	Inside	Outside (pier)
Initial Gate Closed	22/32	16/32	21/32	14/32
Gate Full Open	22/32	16/32	21/32	14/32
Final Gate Closed	22/32	16/32	21/32	14/32

3-D Trunnion Hub Movements - Unloaded vs. Loaded

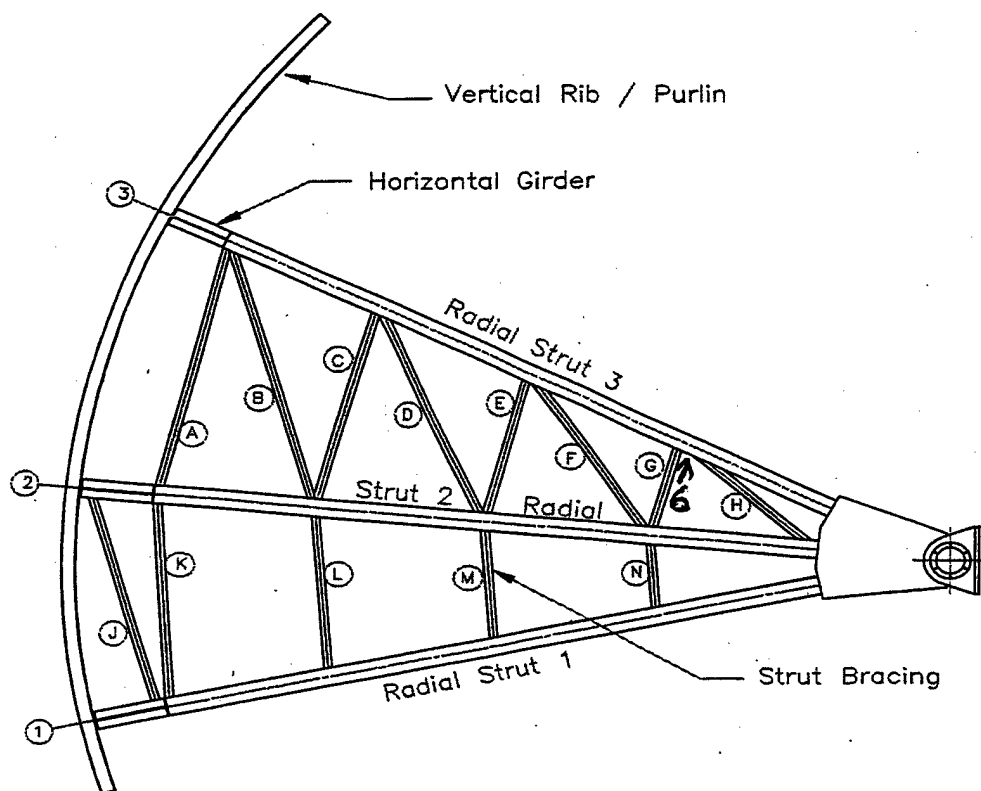
	LEFT				RIGHT			
	No Load Void Dry		Full Load Void Full		No Load Void Dry		Full Load Void Full	
Vertical	0.0000		+0.0035		0.0000		0.0000	
US/DS	+0.0015		+0.0260		+0.0010		+0.0185	
Transverse	22/32	16/32	22/32	16/32	21/32	14/32	21/32	14/32
	Inside	Outside	Inside	Outside	Inside	Outside	Inside	Outside



GATE IS SHIFTED TO RIGHT AT FACE

CRANE NOT AVAILABLE, VOID FILLED VIA GRAVITY, NOT FULL
WHEN MEASURED ≈ 3 LOGS SHOWING

Gate No. 2
Left Elevation B-B



Member	Type	Depth d		Web t _w		Flange(s)			
		Plan (in)	Measured (in)	Plan (in)	Measured (in)	b _f Plan (in)	Measured (in)	t _f Plan (in)	Measured (in)
Strut 3	14 WF 202	15 5/8	15 3/4	15/16		15 3/4	15 3/4	1 1/2	1 1/2
Strut 2	14 WF 342	17 1/2	17 5/8	1 9/16		16 3/8	16 3/16	2 7/16	2 1/2
Strut 1	14 WF 398	18 1/4	18 1/4	1 13/16		16 5/8	16 5/8	2 13/16	2 13/16
Brace A	14 WF 30	13 7/8	14	5/16		6 3/4	6 3/16	3/8	3/8
Brace B	14 WF 30	13 7/8	14	5/16		6 3/4	6 3/4	3/8	3/8
Brace C	14 WF 30	13 7/8	14 1/16	5/16		6 3/4	6 3/4	3/8	3/8
Brace D	14 WF 30	13 7/8	14	5/16		6 3/4	6 13/16	3/8	3/8
Brace E	14 WF 30	13 7/8	14 1/16	5/16		6 3/4	6 13/16	3/8	3/8
Brace F	14 WF 30	13 7/8	14	5/16		6 3/4	6 13/16	3/8	3/8
Brace G	14 WF 30	13 7/8	14	5/16		6 3/4		3/8	
Brace H	14 WF 30	13 7/8	14	5/16		6 3/4		3/8	
Brace J	14 WF 30	13 7/8	14	5/16		6 3/4	6 13/16	3/8	3/8
Brace K	14 WF 30	13 7/8	14 1/16	5/16		6 3/4	6 3/4	3/8	3/8
Brace L	14 WF 30	13 7/8	14 1/16	5/16		6 3/4	6 3/4	3/8	3/8
Brace M	14 WF 30	13 7/8	13 15/16	5/16		6 3/4	6 3/4	3/8	3/8
Brace N	14 WF 30	13 7/8	13 5/16	5/16		6 3/4	6 3/4	3/8	3/8

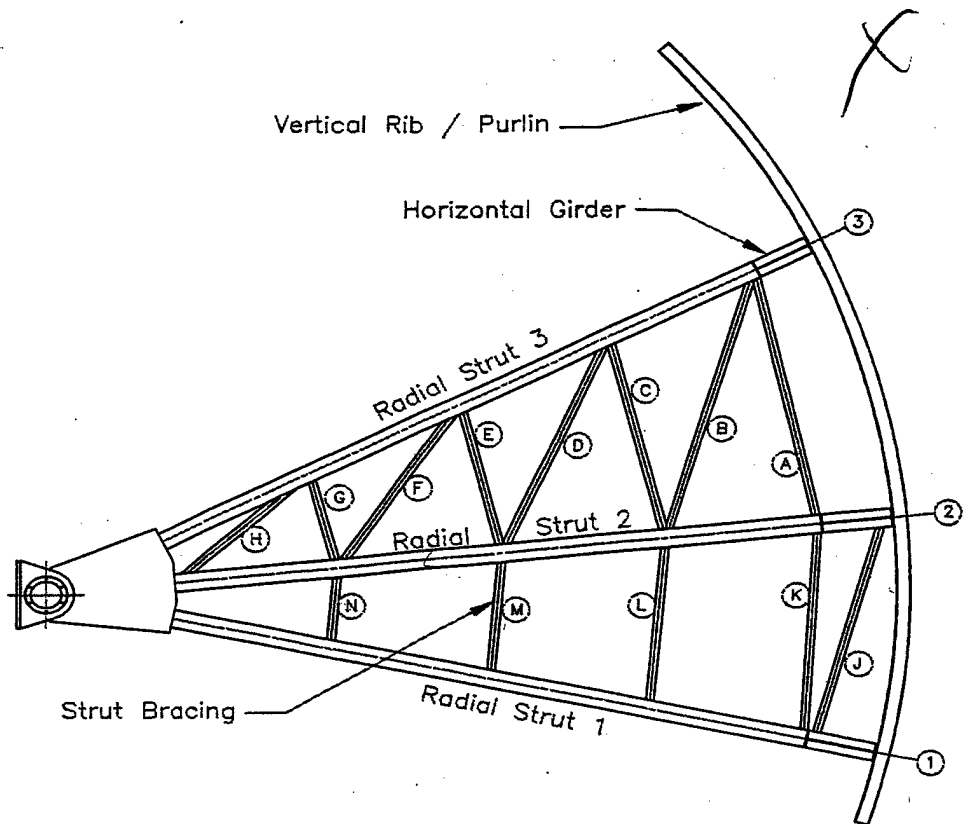
6. Weld cut hole in top Strut.

18. RT. Trunnion

17. OVERLAP GATE Pic.

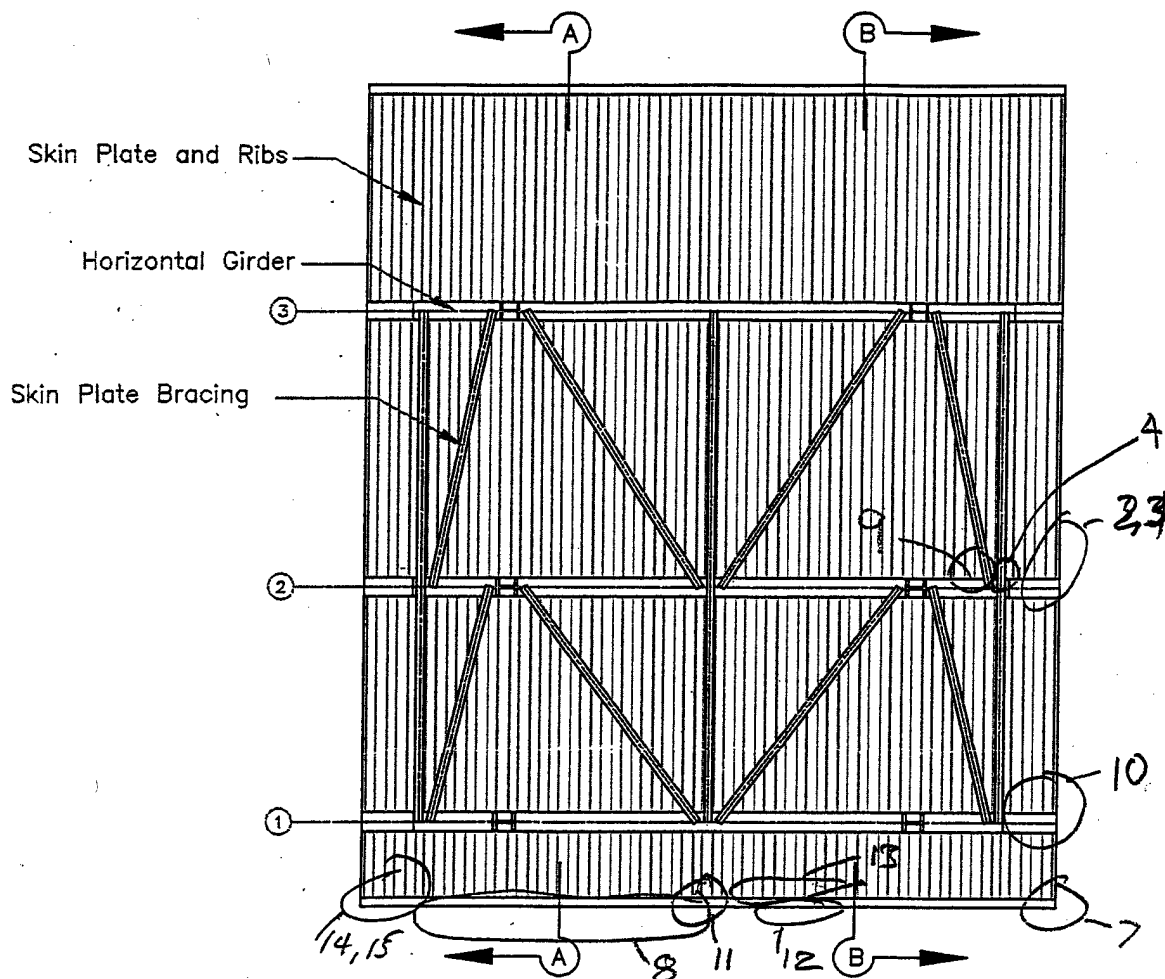
16. LFT Trunnion

Gate No. 2
Right Elevation A-A



Member	Type	Depth d		Web t _w		Flange(s)			
		Plan (in)	Measured (in)	Plan (in)	Measured (in)	Plan (in)	Measured (in)	Plan (in)	Measured (in)
Strut 3	14 WF 202	15 5/8	15 3/4	15/16		15 3/4	15 3/4	1 1/2	1 1/2
Strut 2	14 WF 342	17 1/2	17 1/2	1 9/16		16 3/8	16 3/8	2 7/16	2 1/2
Strut 1	14 WF 398	18 1/4	18 1/4	1 13/16		16 5/8	16 5/8	2 13/16	2 1/2
Brace A	14 WF 30	13 7/8	14	5/16		6 3/4	6 13/16	3/8	3/8
Brace B	14 WF 30	13 7/8	14 1/16	5/16		6 3/4	6 13/16	3/8	
Brace C	14 WF 30	13 7/8	14	5/16		6 3/4	6 13/16	3/8	
Brace D	14 WF 30	13 7/8	14 1/16	5/16		6 3/4	6 3/4	3/8	
Brace E	14 WF 30	13 7/8	14 1/16	5/16		6 3/4	6 3/4	3/8	
Brace F	14 WF 30	13 7/8	14	5/16		6 3/4	6 13/16	3/8	
Brace G	14 WF 30	13 7/8	14 1/16	5/16		6 3/4	6 13/16	3/8	
Brace H	14 WF 30	13 7/8	14 1/16	5/16		6 3/4	6 3/4	3/8	3/8
Brace J	14 WF 30	13 7/8	14 1/16	5/16		6 3/4	6 3/4	3/8	7/16
Brace K	14 WF 30	13 7/8	14 1/16	5/16		6 3/4	6 3/4	3/8	7/16
Brace L	14 WF 30	13 7/8	14 1/16	5/16		6 3/4	6 3/4	3/8	3/8
Brace M	14 WF 30	13 7/8	14 1/16	5/16		6 3/4	6 5/16	3/8	3/8
Brace N	14 WF 30	13 7/8	14 1/16	5/16		6 3/4	6 3/4	3/8	3/8

Gate No. 2 Downstream Elevation



14, 15 Mark in Bot. Girder

Member	Type	Depth		Web		Flange - End			
		Plan (in)	Measured (in)	Plan (in)	Measured (in)	b _t		t _f	
Horiz. Girder 3	PL Girder	49 3/4	49 3/4	7/16	1/2	16	16	7/8	3/8
Horiz. Girder 2	PL Girder	60 1/2	60 5/8	3/4		16 1/2	16 1/2	1 1/4	1 1/4
Horiz. Girder 1	PL Girder	60 1/2	60 1/2	1		16 1/2	16 1/2	1 1/4	1 1/4
Purlins	ST 10 WF 31	10 1/2	10 9/16	13/32		8 1/4	8 1/4	5/8	5/8
Skin PL Bracing	ST 7 WF 15	7	7	1/4	5/16	6 3/4	6 3/4	3/8	3/8

2, 3 Delam. Coating (Paint?)

4. Sway int Vert bracing $\approx 1/4"$. The weld is Bent @ Splice

5. Same as 4 $\approx 1"$

7, 8 Bottom Seal Leaks

9. Bot. Girder Moderate to Heavy Rust on Flange under int. (Typ Picture)

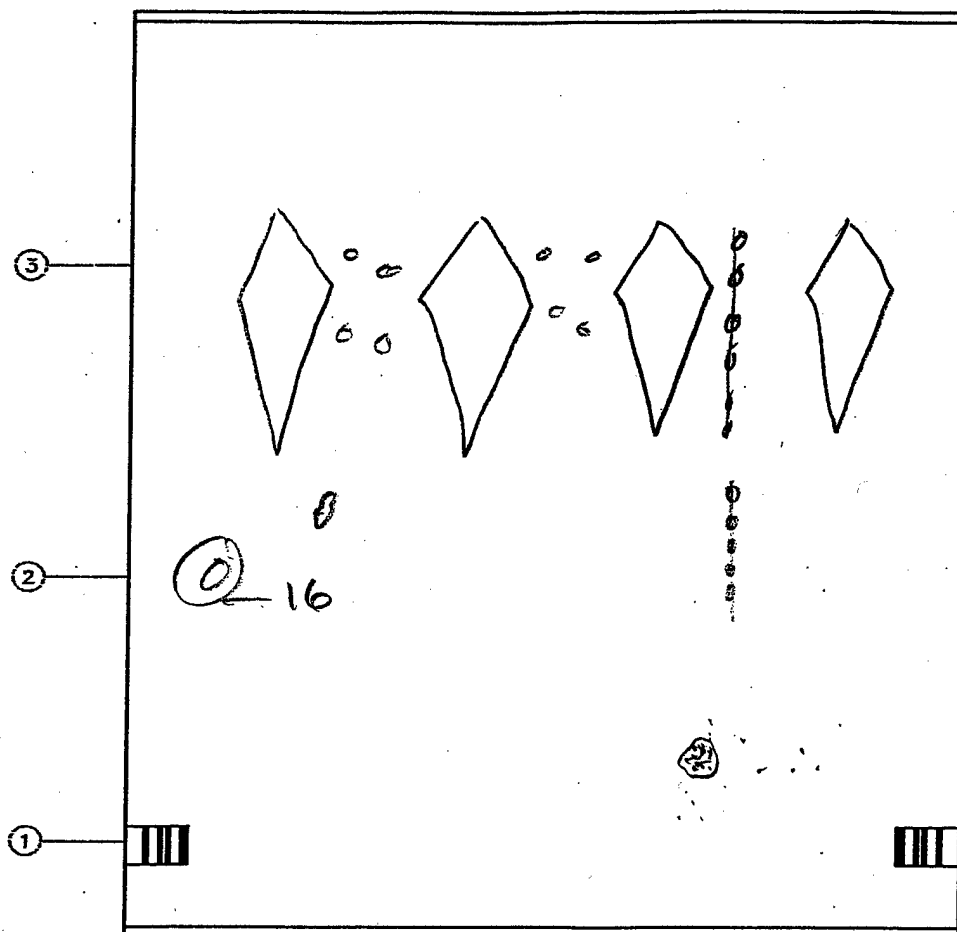
this is also seal on LFT Bot. Shot Flag

10. LFT Bot Girder Brace Pts w/ mod and evidence of standing H₂O

11, 12 Leaks @ Bot. Seal

13 Standing H₂O @ Bot. Plate

Gate No. 2 Upstream Elevation _____



- Paint Flaking off During Pressure Wash ($\frac{1}{4}$ in)

16: Typ Potting hole $\approx \frac{1}{8}$ " to $\frac{1}{4}$ " depth

17

(18)

- MORE COR? PITTING IN. $\frac{1}{2}$ " R THAN OTHER GATES (TVA)

(20) Corroded weld on left of gate, $\frac{1}{4}$ " deep.
21, 22

Gate No. 2 Operation and Trunnion Measurements

Racking Measurements: Bottom of Gate and Spillway

LEFT	RIGHT
35 3/4	36 1/2

Transverse Trunnion Hub Movement, No Load on Gate: Closed-Open-Closed

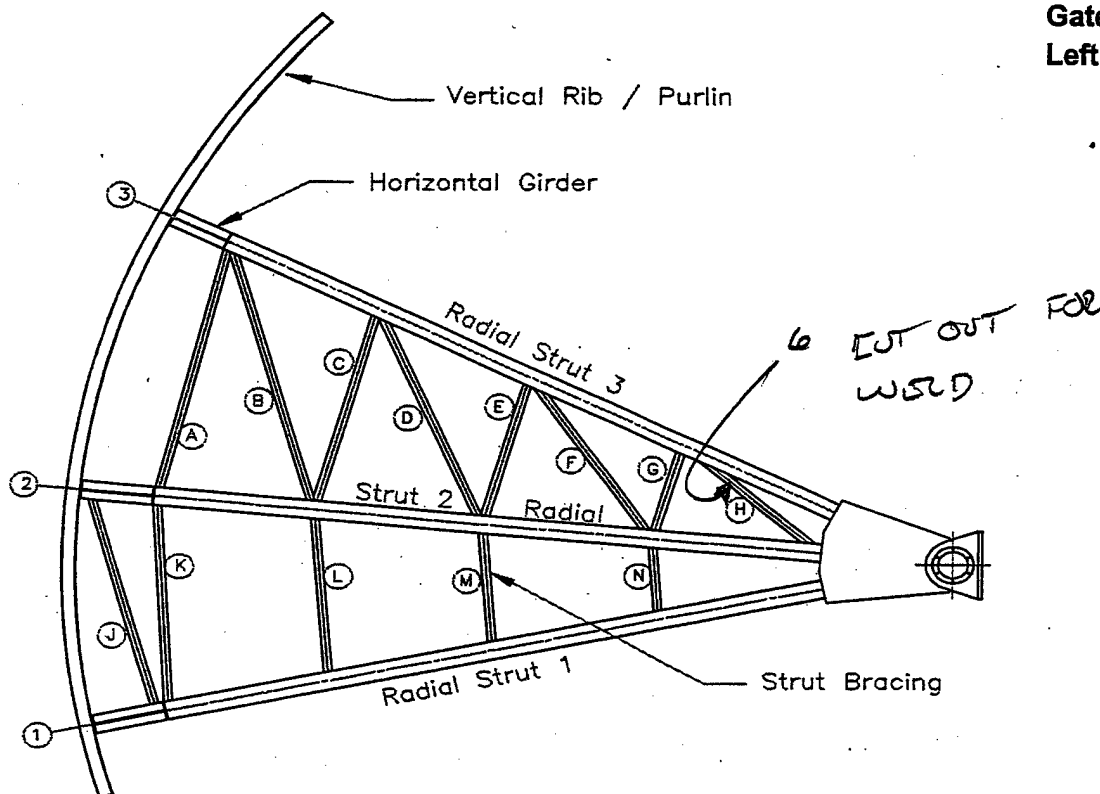
	LEFT		RIGHT	
	Inside	Outside (pier)	Inside	Outside (pier)
Initial Gate Closed	24/32	16/32	21/32	17/32
Gate Full Open	23/32	16/32	22/32	17/32
Final Gate Closed	24/32	16/32	21/32	17/32

3-D Trunnion Hub Movements - Unloaded vs. Loaded

	LEFT				RIGHT			
	No Load Void Dry		Full Load Void Full		No Load Void Dry		Full Load Void Full	
Vertical					0.0000		-0.0020	
US / DS					0.0000		+0.0390	
Transverse	23/32	16/32	23/32	16/32	21/32	17/32	21/32	17/32
	Inside	Outside	Inside	Outside	Inside	Outside	Inside	Outside

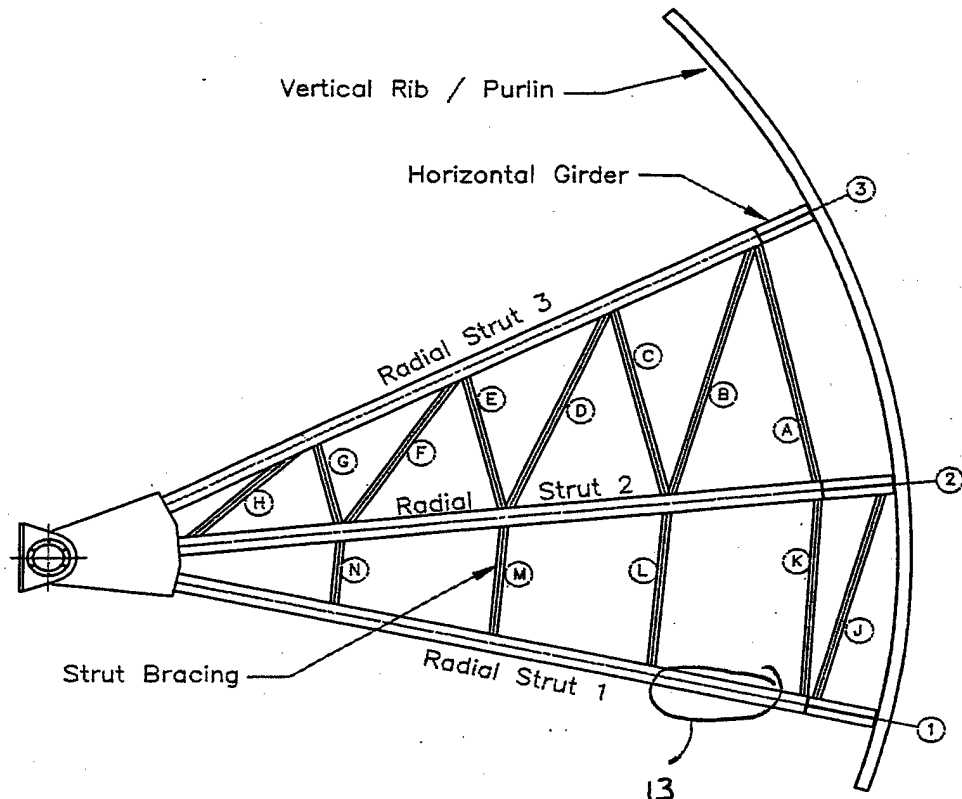
ROCK POCKET / VOID IN SPILLWAY. 10 FT FROM RT PIER

Gate No. 3
Left Elevation B-B



Member	Type	Depth d		Web t _w		Flange(s)			
		Plan (in)	Measured (in)	Plan (in)	Measured (in)	b _f		t _f	
Strut 3	14 WF 202	15 5/8	15 3/4	15/16	—	15 3/4	15 3/4	1 1/2	1 9/16
Strut 2	14 WF 342	17 1/2	17 1/2	1 9/16	—	16 3/8	16 3/16	2 7/16	2 1/2
Strut 1	14 WF 398	18 1/4	18 1/4	1 13/16	—	16 5/8	16 5/8	2 13/16	2 13/16
Brace A	14 WF 30	13 7/8	14	5/16	5/16	6 3/4	6 7/8	3/8	3/8
Brace B	14 WF 30	13 7/8	14	5/16	5/16	6 3/4	6 7/8	3/8	3/8
Brace C	14 WF 30	13 7/8	14	5/16	5/16	6 3/4	6 3/4	3/8	3/8
Brace D	14 WF 30	13 7/8	14	5/16	5/16	6 3/4	6 7/8	3/8	3/8
Brace E	14 WF 30	13 7/8	14	5/16	5/16	6 3/4	6 3/4	3/8	3/8
Brace F	14 WF 30	13 7/8	13 7/8	5/16	5/16	6 3/4	6 3/4	3/8	3/8
Brace G	14 WF 30	13 7/8	13 7/8	5/16	5/16	6 3/4	6 3/4	3/8	3/8
Brace H	14 WF 30	13 7/8	14	5/16	5/16	6 3/4	6 13/16	3/8	2/8
Brace J	14 WF 30	13 7/8	13 7/8	5/16	5/16	6 3/4	6 3/4	3/8	3/8
Brace K	14 WF 30	13 7/8	13 7/8	5/16	5/16	6 3/4	6 3/4	3/8	3/8
Brace L	14 WF 30	13 7/8	13 7/8	5/16	5/16	6 3/4	6 3/4	3/8	3/8
Brace M	14 WF 30	13 7/8	14	5/16	5/16	6 3/4	6 3/4	3/8	3/8
Brace N	14 WF 30	13 7/8	13 7/8	5/16	5/16	6 3/4	6 3/4	3/8	3/8

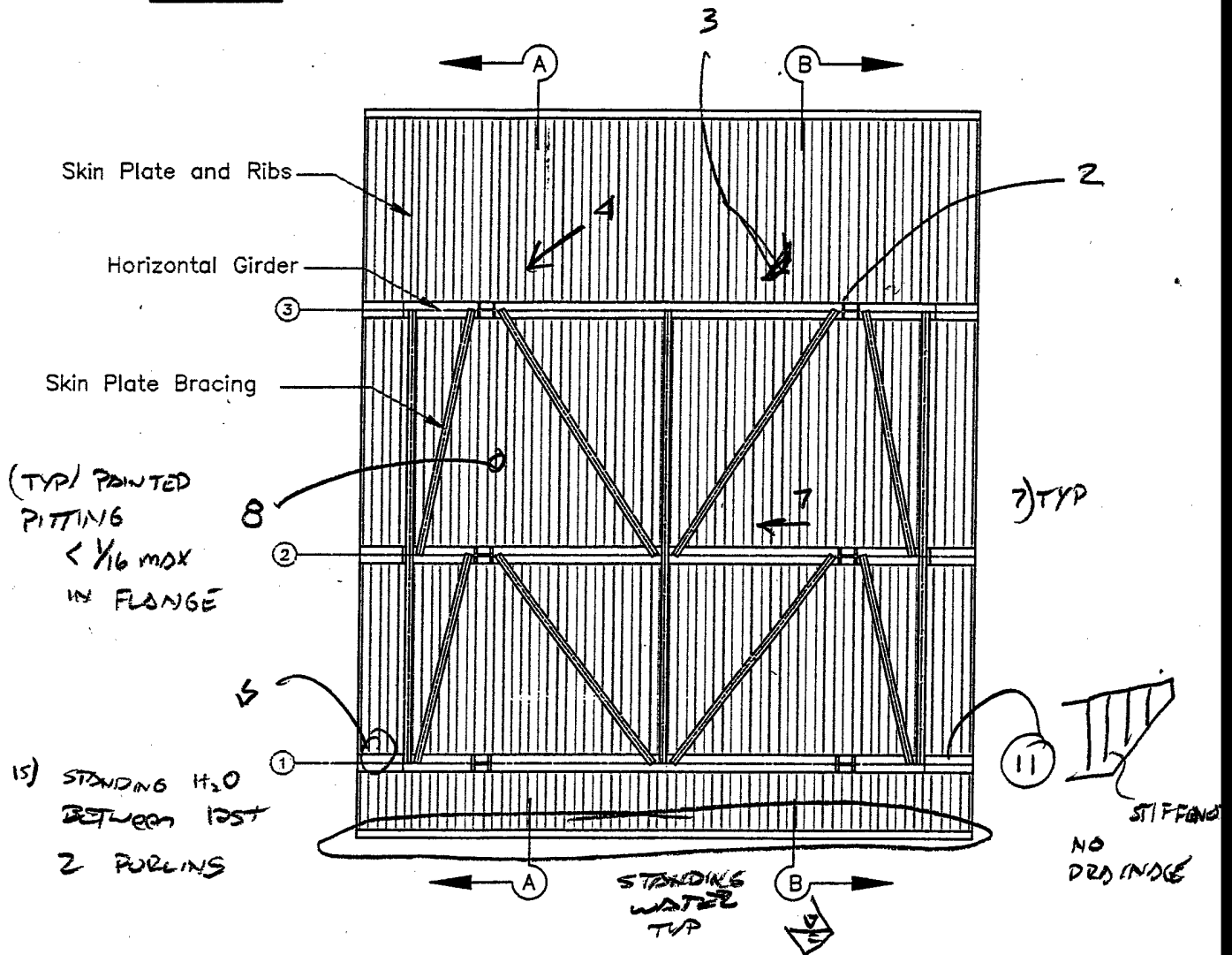
Gate No. 3
Right Elevation A-A



Member	Type	Depth d		Web t _w		Flange(s)			
		Plan (in)	Measured (in)	Plan (in)	Measured (in)	Plan (in)	Measured (in)	Plan (in)	Measured (in)
Strut 3	14 WF 202	15 5/8	15 11/16	15/16	—	15 3/4	15 3/4	1 1/2	1 9/16
Strut 2	14 WF 342	17 1/2	17 1/2	1 9/16	—	16 3/8	16 3/8	2 7/16	2 1/2
Strut 1	14 WF 398	18 1/4	18 3/8	1 13/16	—	16 5/8	16 3/8	2 13/16	2 3/16
Brace A	14 WF 30	13 7/8	13 7/8	5/16	5/16	6 3/4	6 3/4	3/8	3/8
Brace B	14 WF 30	13 7/8	14	5/16	5/16	6 3/4	6 3/4	3/8	3/8
Brace C	14 WF 30	13 7/8	14	5/16	5/16	6 3/4	6 3/4	3/8	3/8
Brace D	14 WF 30	13 7/8	13 7/8	5/16	5/16	6 3/4	6 3/4	3/8	3/8
Brace E	14 WF 30	13 7/8	14	5/16	5/16	6 3/4	6 3/4	3/8	3/8
Brace F	14 WF 30	13 7/8	14	5/16	5/16	6 3/4	6 3/4	3/8	3/8
Brace G	14 WF 30	13 7/8	13 7/8	5/16	5/16	6 3/4	6 3/4	3/8	3/8
Brace H	14 WF 30	13 7/8	13 7/8	5/16	5/16	6 3/4	6 3/4	3/8	3/8
Brace J	14 WF 30	13 7/8	13 7/8	5/16	5/16	6 3/4	6 3/4	3/8	3/8
Brace K	14 WF 30	13 7/8	13 7/8	5/16	5/16	6 3/4	6 3/4	3/8	3/8
Brace L	14 WF 30	13 7/8	13 7/8	5/16	5/16	6 3/4	6 3/4	3/8	3/8
Brace M	14 WF 30	13 7/8	13 7/8	5/16	5/16	6 3/4	6 3/4	3/8	3/8
Brace N	14 WF 30	13 7/8	14	5/16	5/16	6 3/4	6 3/4	3/8	3/8

13) GRIND MARKS

Gate No. 3 Downstream Elevation



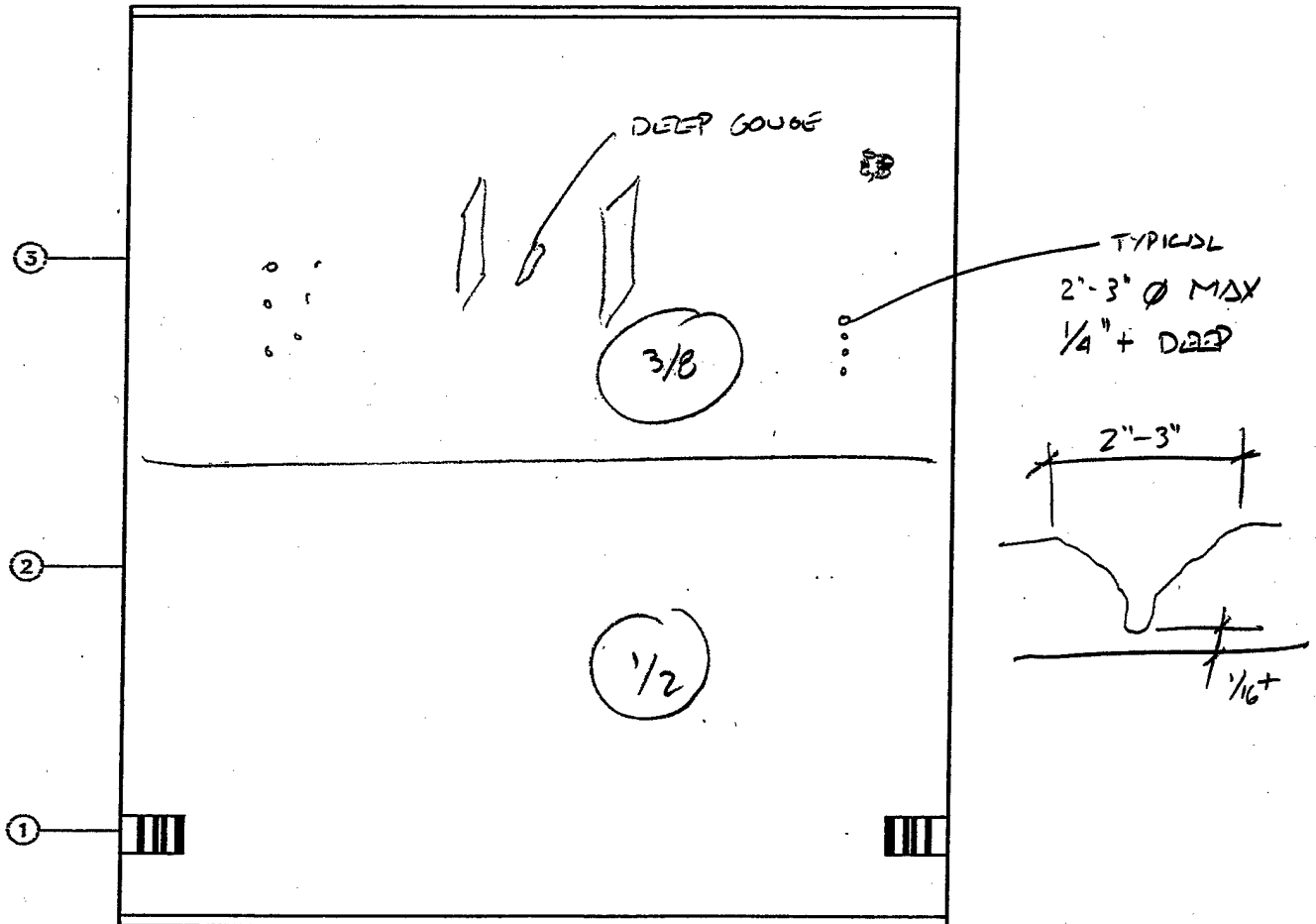
Member	Type	Depth d		Web t _w		Flange - End			
		Plan (in)	Measured (in)	Plan (in)	Measured (in)	Plan (in)	Measured (in)	Plan (in)	Measured (in)
Horiz. Girder 3	PL Girder	49 3/4	50	7/16	7/16	16	16	7/8	7/8
Horiz. Girder 2	PL Girder	60 1/2	60 1/2	3/4	3/4	16 1/2	16 1/2	1 1/4	1 5/16
Horiz. Girder 1	PL Girder	60 1/2	60 3/4	1	1	16 1/2	16 1/2	1 1/4	1 1/4
Purlins	ST 10 WF 31	10 1/2	10 1/2	13/32	-	8 1/4	8 1/4	5/8	5/8
Skin PL Bracing	ST 7 WF 15	7	7	1/4	1/4	6 3/4	6 3/4	3/8	3/8

2) DELTA LIGHT COR.

3) TYP NOTE: NO WELDS U.S. STIFF

4) NO DIRECT DRAINAGE

Gate No. 3 Upstream Elevation



- HEAVY PITTING

- APPROX 4' GRID AVERAGED

- AVG 2'-3" Ø 1/4" + IN 3/8 R ; 3/8" DEEP IN 1/2" R

Gate No. 3 Operation and Trunnion Measurements

Racking Measurements: Bottom of Gate and Spillway

LEFT	RIGHT
47	47

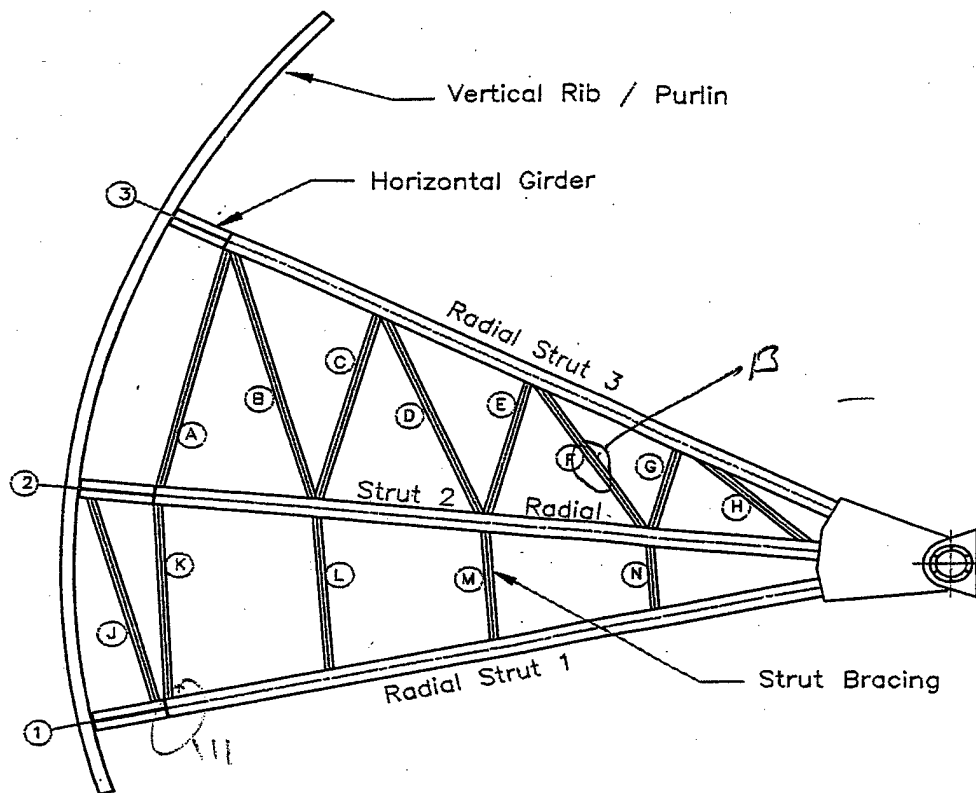
Transverse Trunnion Hub Movement, No Load on Gate: Closed-Open-Closed

	LEFT		RIGHT	
	Inside	Outside (pier)	Inside	Outside (pier)
Initial Gate Closed	24/32	14/32	24/32	17/32
Gate Full Open	24/32	14/32	24/32	17/32
Final Gate Closed	24/32	14/32	24/32	17/32

3-D Trunnion Hub Movements - Unloaded vs. Loaded

	LEFT				RIGHT			
	No Load Void Dry		Full Load Void Full		No Load Void Dry		Full Load Void Full	
Vertical	-0.0005		-0.0040					
US / DS	0.0000		+0.0285					
Transverse	24/32	14/32	24/32	14/32	24/32	17/32	24/32	17/32
	Inside	Outside	Inside	Outside	Inside	Outside	Inside	Outside

Gate No. 4
~~Left~~ Elevation B-B
Right

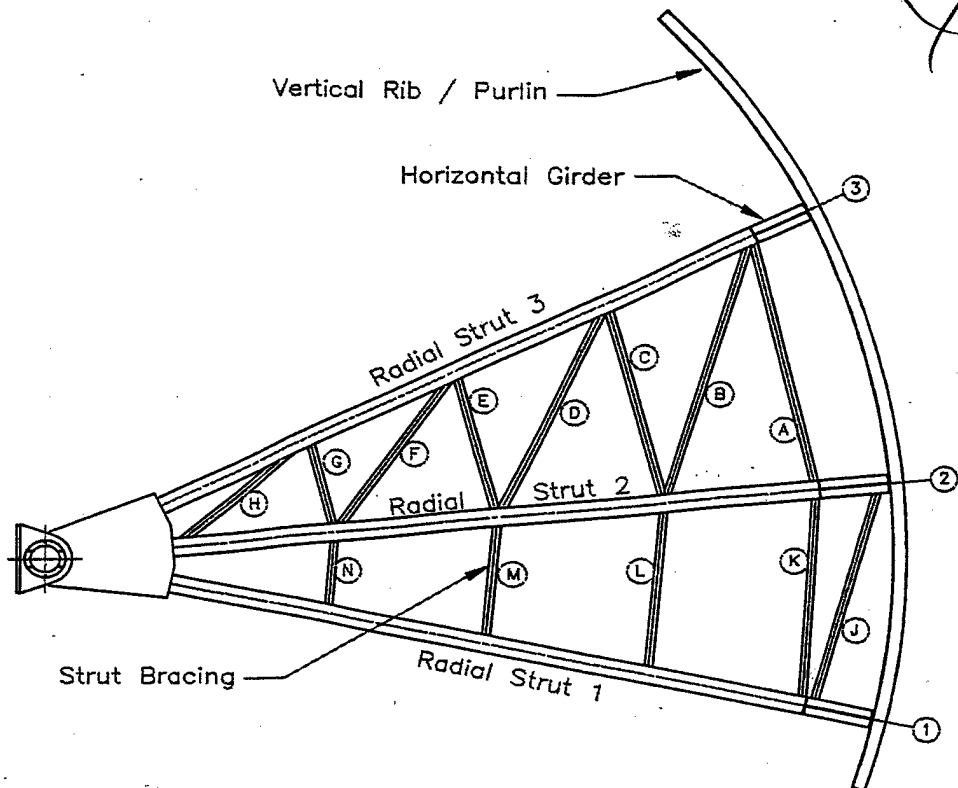


Member	Type	Depth d		Web t _w		Flange(s)			
		Plan (in)	Measured (in)	Plan (in)	Measured (in)	b _f		t _f	
Strut 3	14 WF 202	15 5/8	15 5/8	15/16		15 3/4	15 3/4	1 1/2	1 1/2
Strut 2	14 WF 342	17 1/2	17 1/2	1 9/16		16 3/8	16 1/8	2 7/16	2 1/2
Strut 1	14 WF 398	18 1/4	18 1/4	1 13/16		16 5/8	16 3/8	2 13/16	2 7/8
Brace A	14 WF 30	13 7/8	14 1/16	5/16		6 3/4	6 13/16	3/8	3/8
Brace B	14 WF 30	13 7/8	13 15/16	5/16		6 3/4	6 1/16	3/8	3/8
Brace C	14 WF 30	13 7/8	13 15/16	5/16		6 3/4	6 13/16	3/8	3/8
Brace D	14 WF 30	13 7/8	13 15/16	5/16		6 3/4	6 13/16	3/8	3/8
Brace E	14 WF 30	13 7/8	14	5/16		6 3/4	6 7/8	3/8	3/8
Brace F	14 WF 30	13 7/8	14 1/16	5/16		6 3/4	6 13/16	3/8	3/8
Brace G	14 WF 30	13 7/8	13 15/16	5/16		6 3/4	6 13/16	3/8	3/8
Brace H	14 WF 30	13 7/8	13 15/16	5/16		6 3/4	6 7/8	3/8	3/8
Brace J	14 WF 30	13 7/8	13 7/8	5/16		6 3/4	6 3/4	3/8	3/8
Brace K	14 WF 30	13 7/8	13 7/8	5/16		6 3/4	6 9/16	3/8	3/8
Brace L	14 WF 30	13 7/8	14	5/16		6 3/4	6 7/8	3/8	3/8
Brace M	14 WF 30	13 7/8	14	5/16		6 3/4	6 9/16	3/8	3/8
Brace N	14 WF 30	13 7/8	14	5/16		6 3/4	6 7/8	3/8	3/8

11. Clogged Drain Hole w/ moss growth (standing H₂O above)

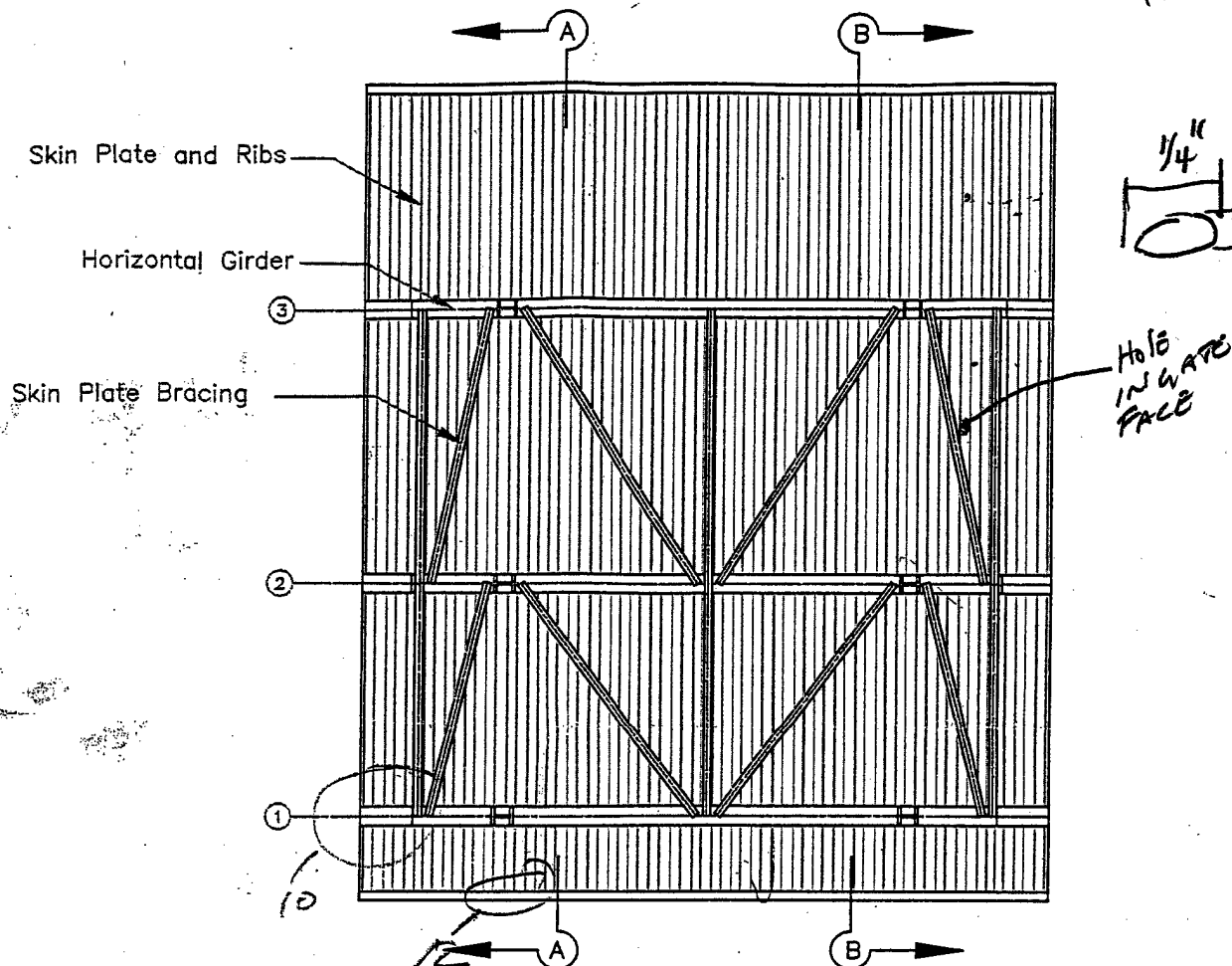
13. Small Deflection in Flange Against Pier ± 1/16" - 1/8"

Gate No. 4
~~Right Elevation A-A~~
LEFT



Member	Type	Depth		Web		Flange(s)			
		d		t _w		b _f		t _f	
		Plan (in)	Measured (in)	Plan (in)	Measured (in)	Plan (in)	Measured (in)	Plan (in)	Measured (in)
Strut 3	14 WF 202	15 5/8	15 3/8	15/16		15 3/4	15 3/8	1 1/2	1 1/2
Strut 2	14 WF 342	17 1/2	17 1/2	1 9/16		16 3/8	16 3/16	2 7/16	2 1/2
Strut 1	14 WF 398	18 1/4	18 5/16	1 13/16		16 5/8	16 5/16	2 13/16	2 13/16
Brace A	14 WF 30	13 7/8	13 5/16	5/16		6 3/4	6 3/16	3/8	3/8
Brace B	14 WF 30	13 7/8	13 7/8	5/16		6 3/4	6 7/8	3/8	3/8
Brace C	14 WF 30	13 7/8	13 7/8	5/16		6 3/4	6 3/16	3/8	3/8
Brace D	14 WF 30	13 7/8	13 5/16	5/16		6 3/4	6 3/4	3/8	3/8
Brace E	14 WF 30	13 7/8	14	5/16		6 3/4	6 1/2	3/8	3/8
Brace F	14 WF 30	13 7/8	13 5/16	5/16		6 3/4	6 15/16	3/8	3/8
Brace G	14 WF 30	13 7/8	13 5/16	5/16		6 3/4	6 3/4	3/8	3/8
Brace H	14 WF 30	13 7/8	14 1/4	5/16		6 3/4	6 7/8	3/8	3/8
Brace J	14 WF 30	13 7/8	13 15/16	5/16		6 3/4	6 7/8	3/8	3/8
Brace K	14 WF 30	13 7/8	14	5/16		6 3/4	6 3/4	3/8	3/8
Brace L	14 WF 30	13 7/8	13 7/8	5/16		6 3/4	10 13/16	3/8	3/8
Brace M	14 WF 30	13 7/8	13 15/16	5/16		6 3/4	12 13/16	3/8	3/8
Brace N	14 WF 30	13 7/8	13 15/16	5/16		6 3/4	10 3/4	3/8	3/8

Gate No. 4 Downstream Elevation



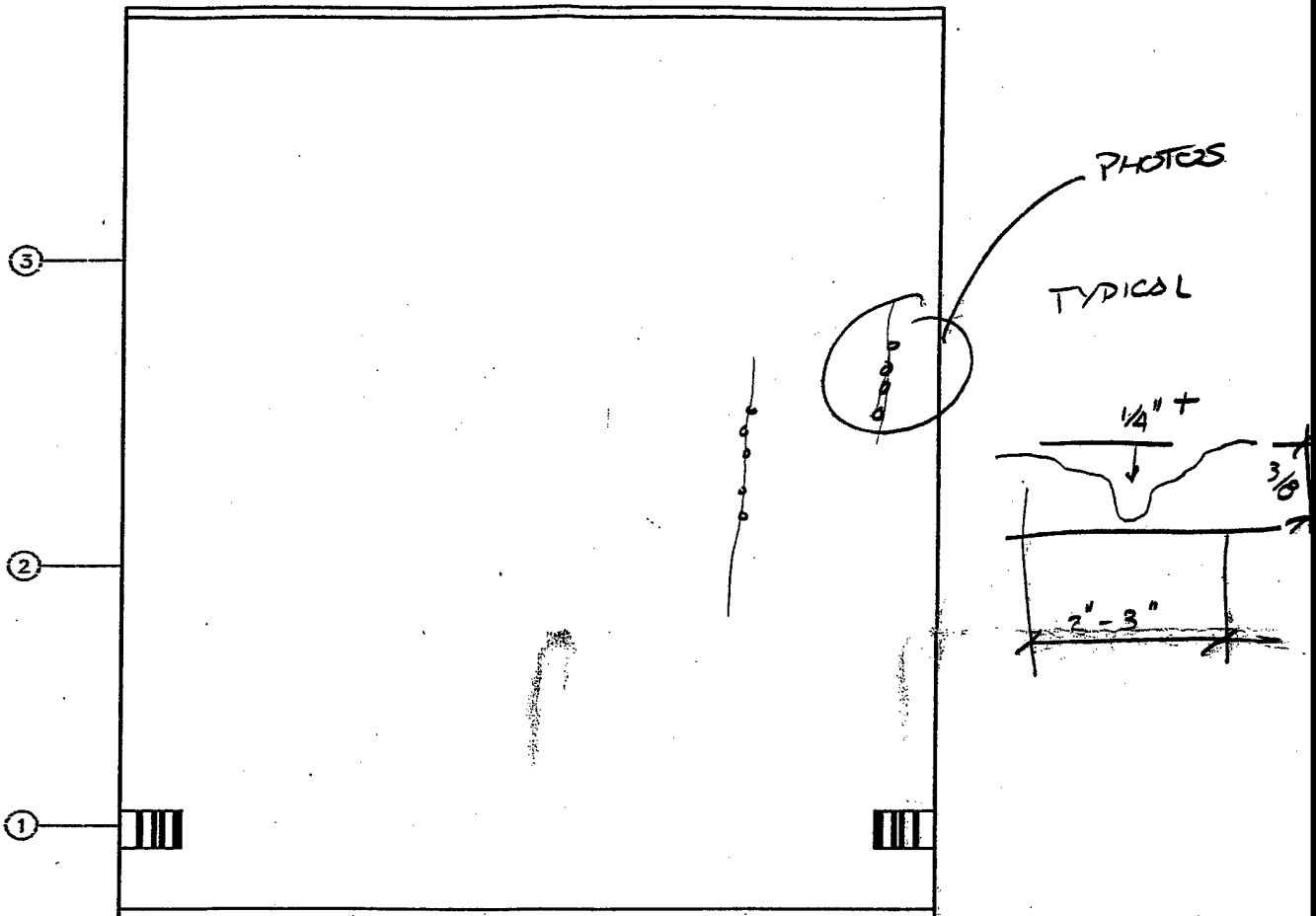
Member	Type	Depth d		Web t _w		Flange - End			
		Plan (in)	Measured (in)	Plan (in)	Measured (in)	Plan (in)	Measured (in)	Plan (in)	Measured (in)
Horiz. Girder 3	PL Girder	49 3/4	49 5/16	7/16	1/2	16	16	7/8	7/8
Horiz. Girder 2	PL Girder	60 1/2	60 1/2	3/4		16 1/2	16 1/2	1 1/4	1 1/4
Horiz. Girder 1	PL Girder	60 1/2	60 3/8	1		16 1/2	16 1/2	1 1/4	1 1/4
Purlins	ST 10 WF 31	10 1/2	10 3/8	13/32		8 1/4	8 1/4	5/8	5/8
Skin PL Bracing	ST 7 WF 15	7	7	1/4	5/16	6 3/4	6 13/16	3/8	3/8

2-9 Holes in Gate Face. $\approx 1/4" \times 1 1/8"$

10. Muck and evidence of standing H₂O

12. Muck @ Bot. Seal Pit. NO DRAINING H₂O's

Gate No. 4 Upstream Elevation



- HEAVY PITTING $> 1/4"$ IN $3/8"$ R ISOLATED SPOTS

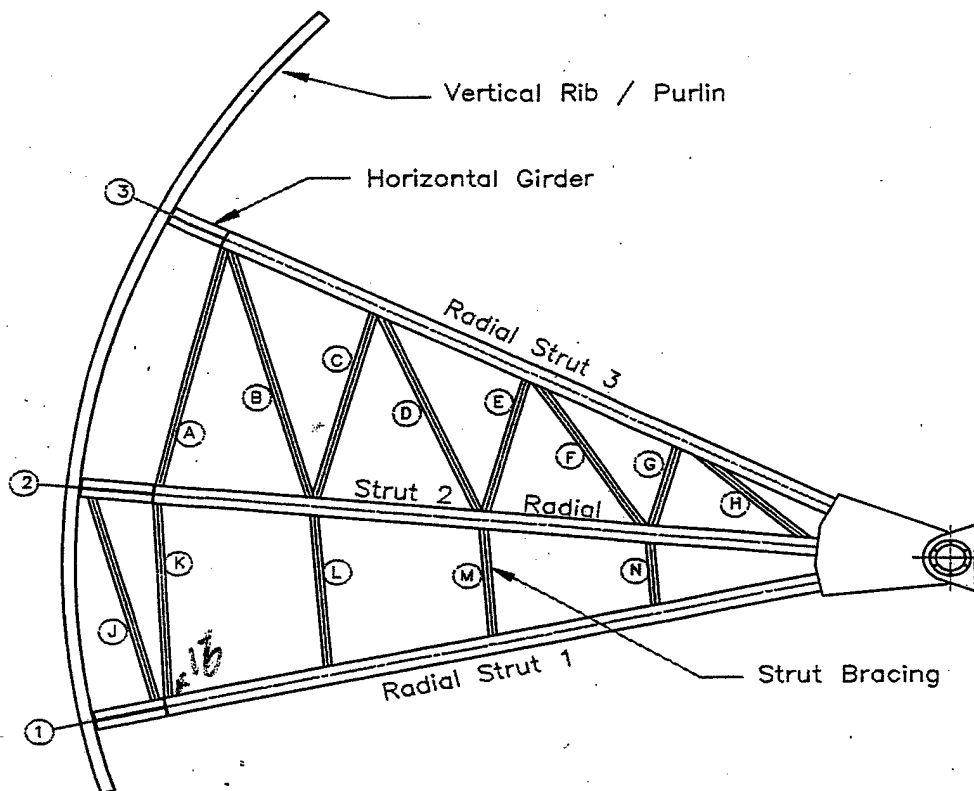
- APPEARS TO FOLLOW SCRATCHES IN R

- TYP 2-3' \emptyset

- AVG, PITT ON 4'-5' GRID

		LEFT				RIGHT			
		No Load Void Dry		Full Load Void Full		No Load Void Dry		Full Load Void Full	
Vertical		0.0000		-0.0020					
US / DS		-0.0020		+0.0305					
Transverse		21/32	16/32	21/32	16/32	22/32	18/32	22/32	18/32
		Inside	Outside	Inside	Outside	Inside	Outside	Inside	Outside

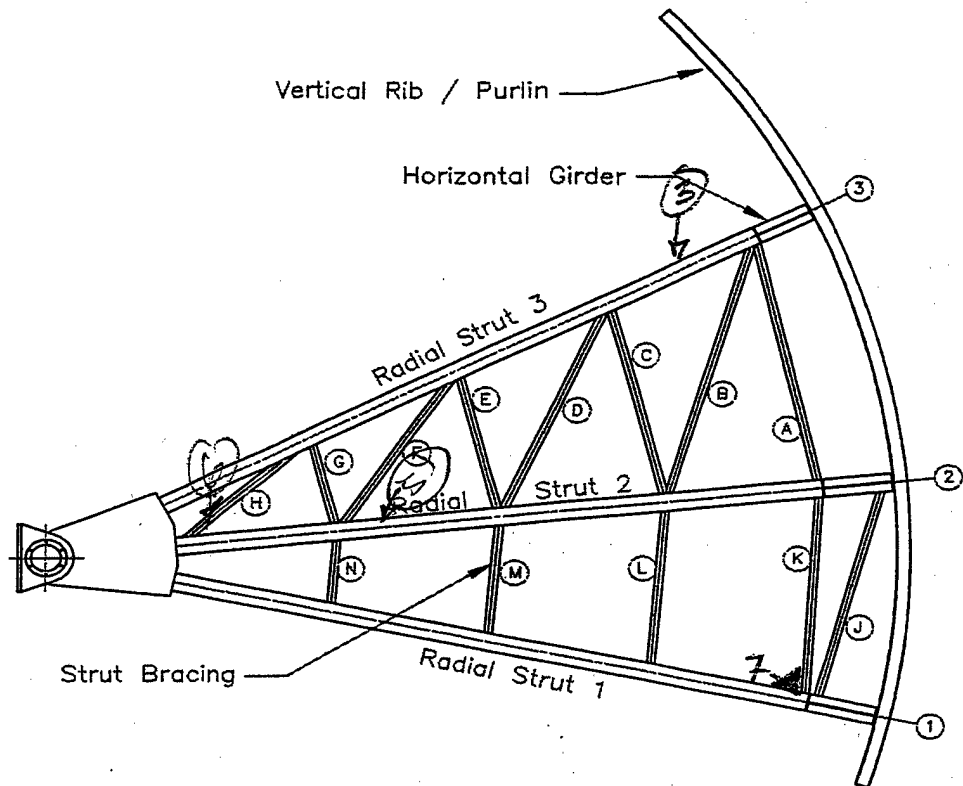
Gate No. 5
Left Elevation B-B



Member	Type	Depth d		Web t _w		Flange(s)			
		Plan (in)	Measured (in)	Plan (in)	Measured (in)	Plan (in)	Measured (in)	Plan (in)	Measured (in)
Strut 3	14 WF 202	15 5/8	15 3/8	15/16	—	15 3/4	15 3/8	1 1/2	✓
Strut 2	14 WF 342	17 1/2	17 1/8	1 9/16	—	16 3/8	16 3/8	2 7/16	✓
Strut 1	14 WF 398	18 1/4	18 3/16	1 13/16	—	16 5/8	16 5/8	2 13/16	✓
Brace A	14 WF 30	13 7/8	14 1/16	5/16	—	6 3/4	6 7/8	3/8	✓
Brace B	14 WF 30	13 7/8	14	5/16	—	6 3/4	6 7/8	3/8	✓
Brace C	14 WF 30	13 7/8	14 1/16	5/16	—	6 3/4	6 7/8	3/8	✓
Brace D	14 WF 30	13 7/8	14	5/16	—	6 3/4	6 7/8	3/8	✓
Brace E	14 WF 30	13 7/8	14	5/16	—	6 3/4	6 7/8	3/8	✓
Brace F	14 WF 30	13 7/8	✓	5/16	—	6 3/4	6 7/8	3/8	✓
Brace G	14 WF 30	13 7/8	14	5/16	—	6 3/4	✓	3/8	✓
Brace H	14 WF 30	13 7/8	14	5/16	—	6 3/4	✓	3/8	✓
Brace J	14 WF 30	13 7/8	14 1/16	5/16	—	6 3/4	6 1/8	3/8	✓
Brace K	14 WF 30	13 7/8	14 1/16	5/16	—	6 3/4	6 7/8	3/8	✓
Brace L	14 WF 30	13 7/8	14	5/16	—	6 3/4	6 7/8	3/8	✓
Brace M	14 WF 30	13 7/8	14	5/16	—	6 3/4	6 3/4	3/8	✓
Brace N	14 WF 30	13 7/8	14	5/16	—	6 3/4	6 7/8	3/8	✓

(15) Left, bottom girder @ cables.
(16) Rounding @ bottom strut

Gate No. 5
Right Elevation A-A



Member	Type	Depth d		Web t _w		Flange(s)			
		Plan (in)	Measured (in)	Plan (in)	Measured (in)	Plan (in)	Measured (in)	Plan (in)	Measured (in)
Strut 3	14 WF 202	15 5/8	✓	15/16	—	15 3/4	15 3/4	1 1/2	✓
Strut 2	14 WF 342	17 1/2	17 1/2	1 9/16	—	16 3/8	16 3/8	2 7/16	✓
Strut 1	14 WF 398	18 1/4	✓	1 13/16	—	16 5/8	16 5/8	2 13/16	2 5/8
Brace A	14 WF 30	13 7/8	✓	5/16	—	6 3/4	✓	3/8	✓
Brace B	14 WF 30	13 7/8	✓	5/16	—	6 3/4	✓	3/8	✓
Brace C	14 WF 30	13 7/8	14 1/8	5/16	—	6 3/4	✓	3/8	✓
Brace D	14 WF 30	13 7/8	✓	5/16	—	6 3/4	✓	3/8	✓
Brace E	14 WF 30	13 7/8	✓	5/16	—	6 3/4	✓	3/8	✓
Brace F	14 WF 30	13 7/8	✓	5/16	—	6 3/4	✓	3/8	✓
Brace G	14 WF 30	13 7/8	✓	5/16	—	6 3/4	✓	3/8	✓
Brace H	14 WF 30	13 7/8	✓	5/16	—	6 3/4	✓	3/8	✓
Brace J	14 WF 30	13 7/8	✓	5/16	—	6 3/4	✓	3/8	✓
Brace K	14 WF 30	13 7/8	✓	5/16	—	6 3/4	✓	3/8	✓
Brace L	14 WF 30	13 7/8	14 1/8	5/16	—	6 3/4	✓	3/8	✓
Brace M	14 WF 30	13 7/8	✓	5/16	—	6 3/4	✓	3/8	✓
Brace N	14 WF 30	13 7/8	✓	5/16	—	6 3/4	✓	3/8	✓

③ Corrosion on top strut

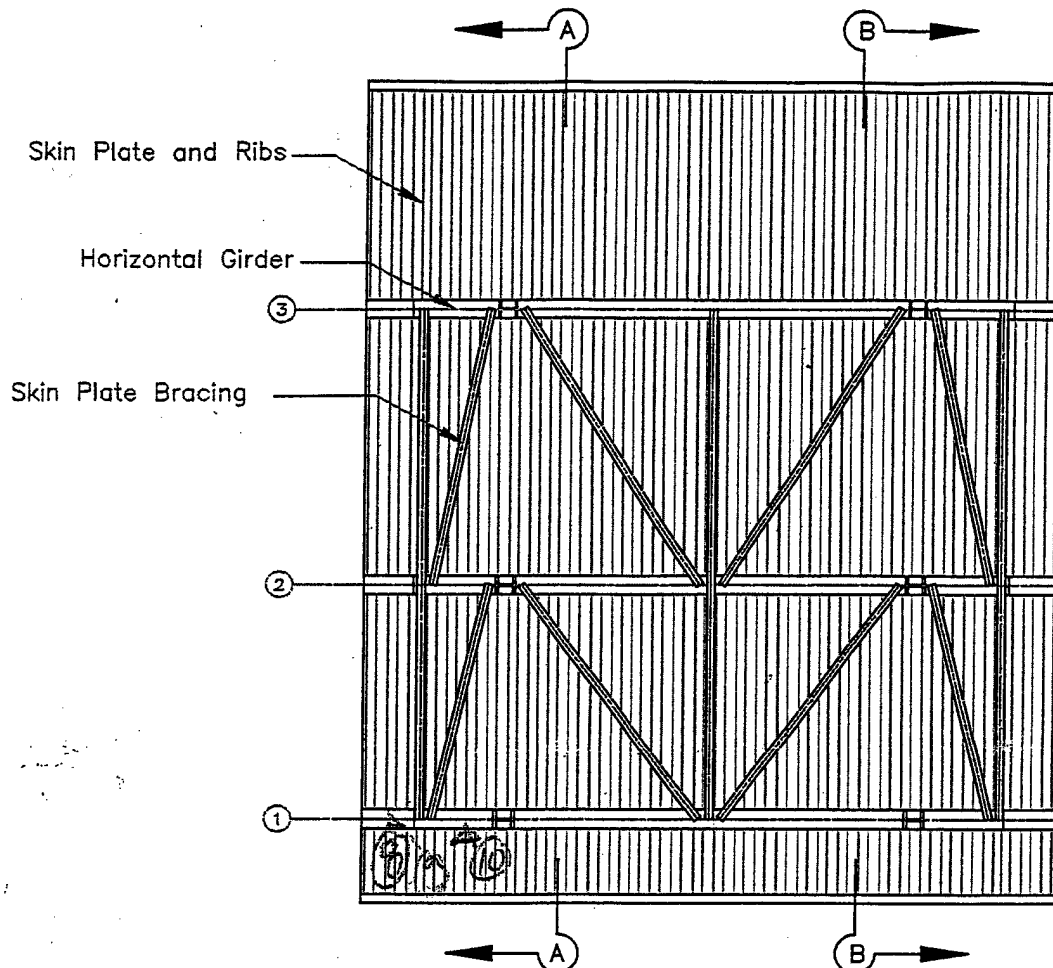
④ Pending water on 2nd girder

⑤ Nick in strut

⑥ Nick in triangular member

⑦ Pending water @ bottom strut

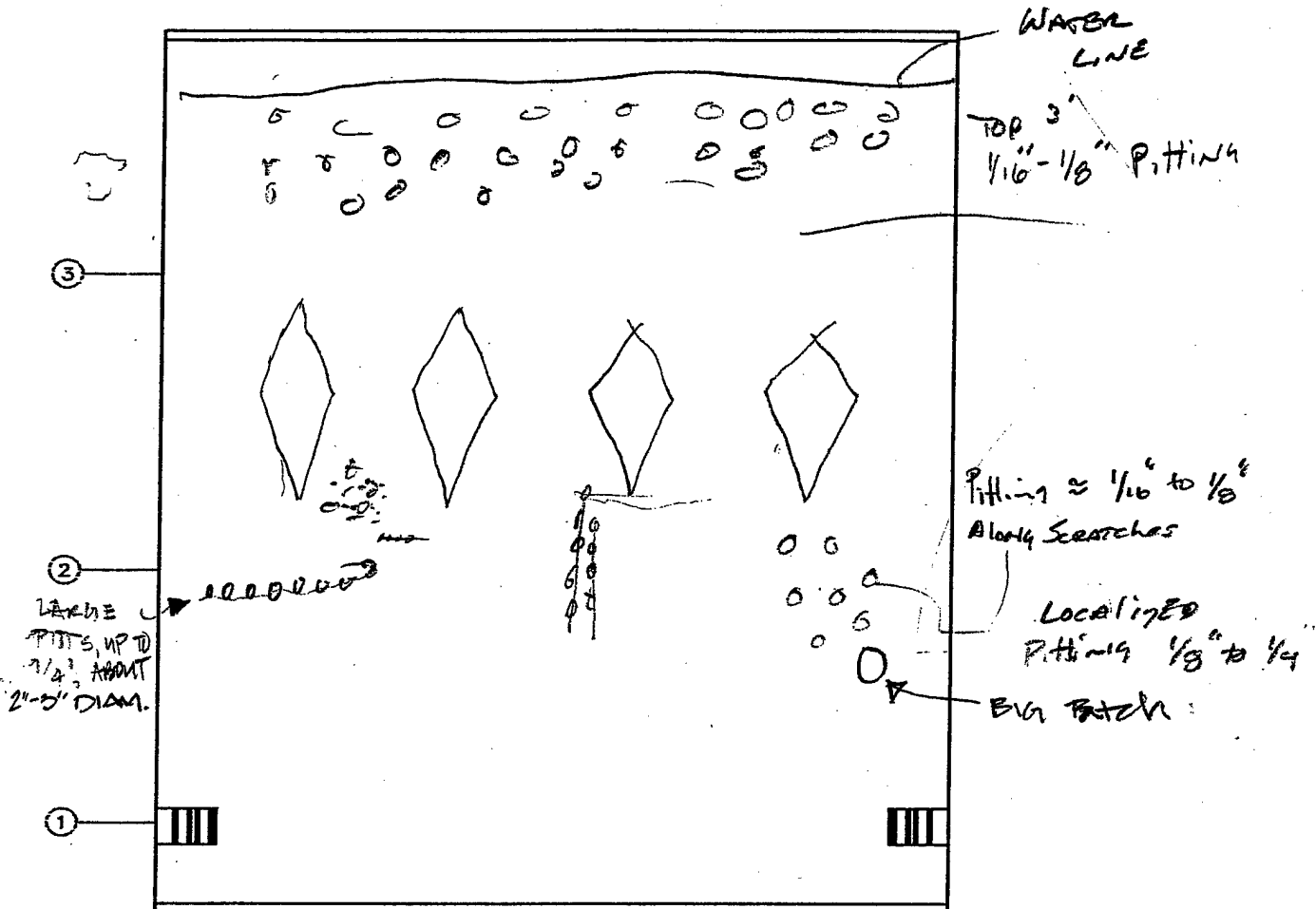
Gate No. 5 Downstream Elevation



Member	Type	Depth		Web		Flange - End			
		Plan (in)	Measured (in)	Plan (in)	Measured (in)	Plan (in)	Measured (in)	Plan (in)	Measured (in)
Horiz. Girder 3	PL Girder	49 3/4	50	7/16	✓	16	✓	7/8	✓
Horiz. Girder 2	PL Girder	60 1/2	✓	3/4	✓	16 1/2	✓	1 1/4	✓
Horiz. Girder 1	PL Girder	60 1/2	✓	1	✓	16 1/2	✓	1 1/4	✓
Purlins	ST 10 WF 31	10 1/2	✓	13/32	✓	8 1/4	✓	5/8	✓
Skin PL Bracing	ST 7 WF 15	7	✓	1/4	✓	6 3/4	✓	3/8	✓

- (1) Leak in side seal, on top girder
 (2) ponding water @ middle
 (3) ponding water overall
 (4) ponding water in bottom girder
 (5) side seal, rivet
 (6) bottom seal from R-L
 (7) ponding in purlins & bottom gate

Gate No. 5 Upstream Elevation



Gate No. 5 Operation and Trunnion Measurements

Racking Measurements: Bottom of Gate and Spillway

LEFT	RIGHT
24 3/4	24 3/4

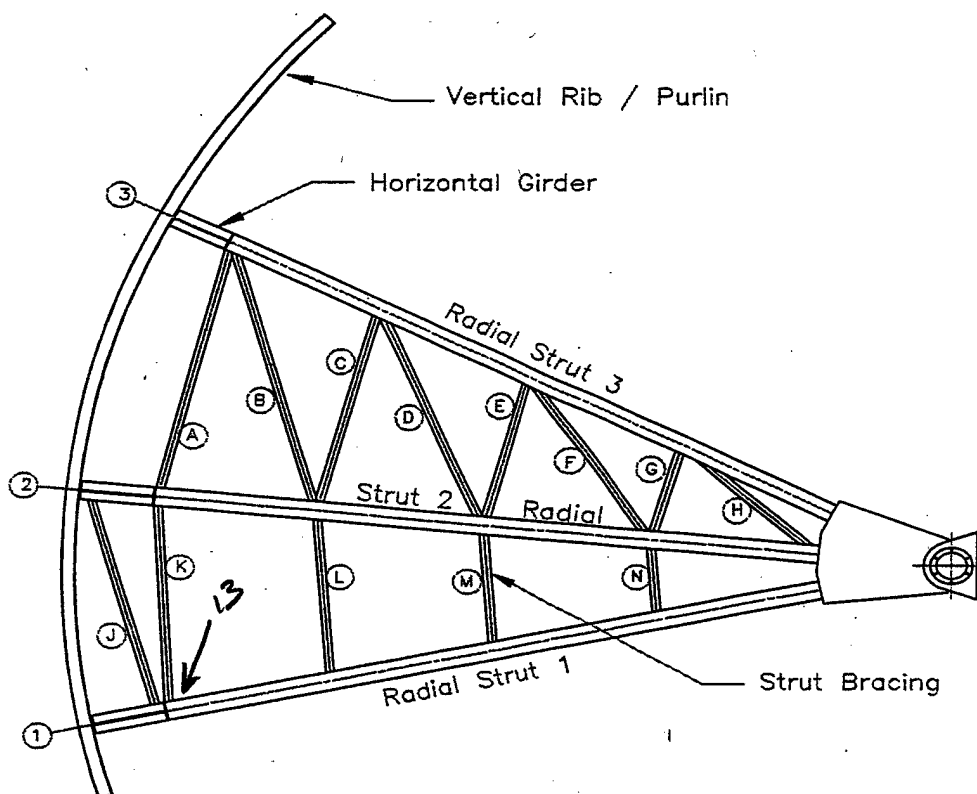
Transverse Trunnion Hub Movement, No Load on Gate: Closed-Open-Closed

	LEFT		RIGHT	
	Inside	Outside (pier)	Inside	Outside (pier)
Initial Gate Closed	22/32	16/32	24/32	16/32
Gate Full Open	20/32	16/32	24/32	16/32
Final Gate Closed	22/32	16/32	24/32	16/32

3-D Trunnion Hub Movements - Unloaded vs. Loaded

	LEFT				RIGHT			
	No Load Void Dry		Full Load Void Full		No Load Void Dry		Full Load Void Full	
Vertical	-0.0005		+0.0150					
US / DS	-0.0030		+0.0510					
Transverse	22/32	16/32	22/32	16/32	24/32	16/32	24/32	16/32
	Inside	Outside	Inside	Outside	Inside	Outside	Inside	Outside

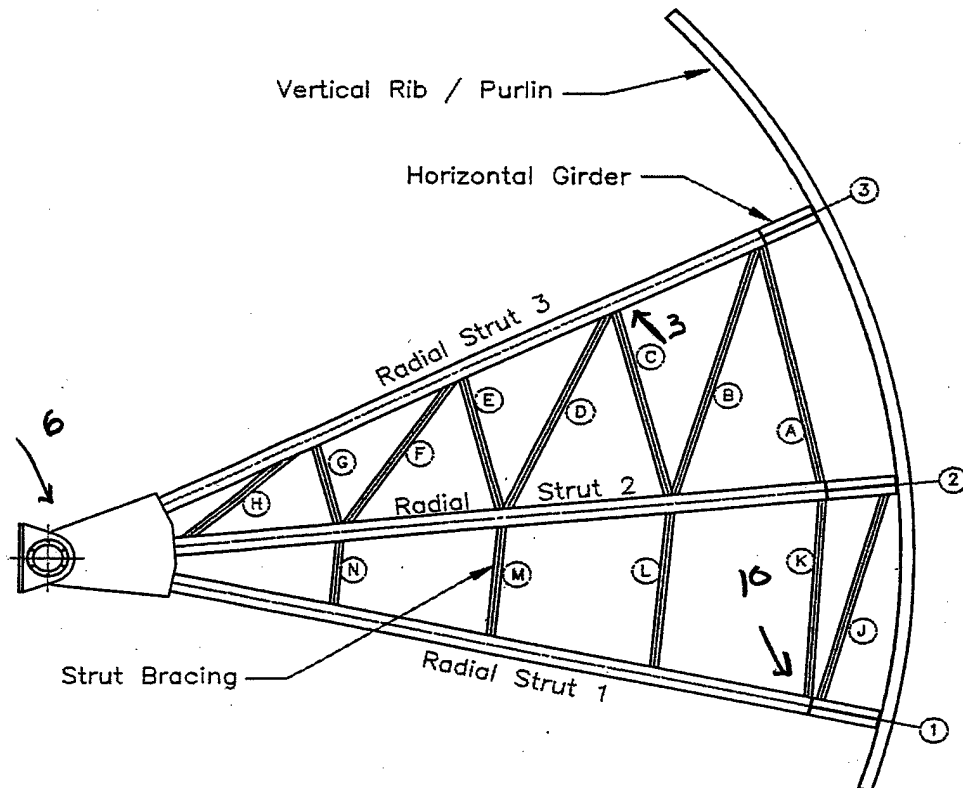
Gate No. 6
Left Elevation B-B



Member	Type	Depth d		Web t _w		Flange(s)			
		Plan (in)	Measured (in)	Plan (in)	Measured (in)	b _f		t _f	
Strut 3	14 WF 202	15 5/8	15 5/8	15/16	—	15 3/4	15 3/4	1 1/2	1 1/2
Strut 2	14 WF 342	17 1/2	17 5/8	1 9/16	—	16 3/8	16 3/8	2 7/16	2 1/2
Strut 1	14 WF 398	18 1/4	18 5/16	1 13/16	—	16 5/8	16 3/8	2 13/16	2 7/8
Brace A	14 WF 30	13 7/8	14	5/16	5/16	6 3/4	6 3/4	3/8	3/8
Brace B	14 WF 30	13 7/8	14	5/16	5/16	6 3/4	6 3/4	3/8	3/8
Brace C	14 WF 30	13 7/8	13 15/16	5/16	5/16	6 3/4	6 3/4	3/8	3/8
Brace D	14 WF 30	13 7/8	14	5/16	5/16	6 3/4	6 3/4	3/8	3/8
Brace E	14 WF 30	13 7/8	14	5/16	5/16	6 3/4	6 3/4	3/8	3/8
Brace F	14 WF 30	13 7/8	14	5/16	5/16	6 3/4	6 3/4	3/8	3/8
Brace G	14 WF 30	13 7/8	14	5/16	5/16	6 3/4	6 3/4	3/8	3/8
Brace H	14 WF 30	13 7/8	14	5/16	5/16	6 3/4	6 3/4	3/8	3/8
Brace J	14 WF 30	13 7/8	14	5/16	5/16	6 3/4	6 3/4	3/8	3/8
Brace K	14 WF 30	13 7/8	14	5/16	5/16	6 3/4	6 3/4	3/8	3/8
Brace L	14 WF 30	13 7/8	13 7/8	5/16	5/16	6 3/4	6 3/4	3/8	3/8
Brace M	14 WF 30	13 7/8	14	5/16	5/16	6 3/4	6 3/4	3/8	3/8
Brace N	14 WF 30	13 7/8	14	5/16	5/16	6 3/4	6 3/4	3/8	3/8

13) LIGHT COR, POST STANDING WATER

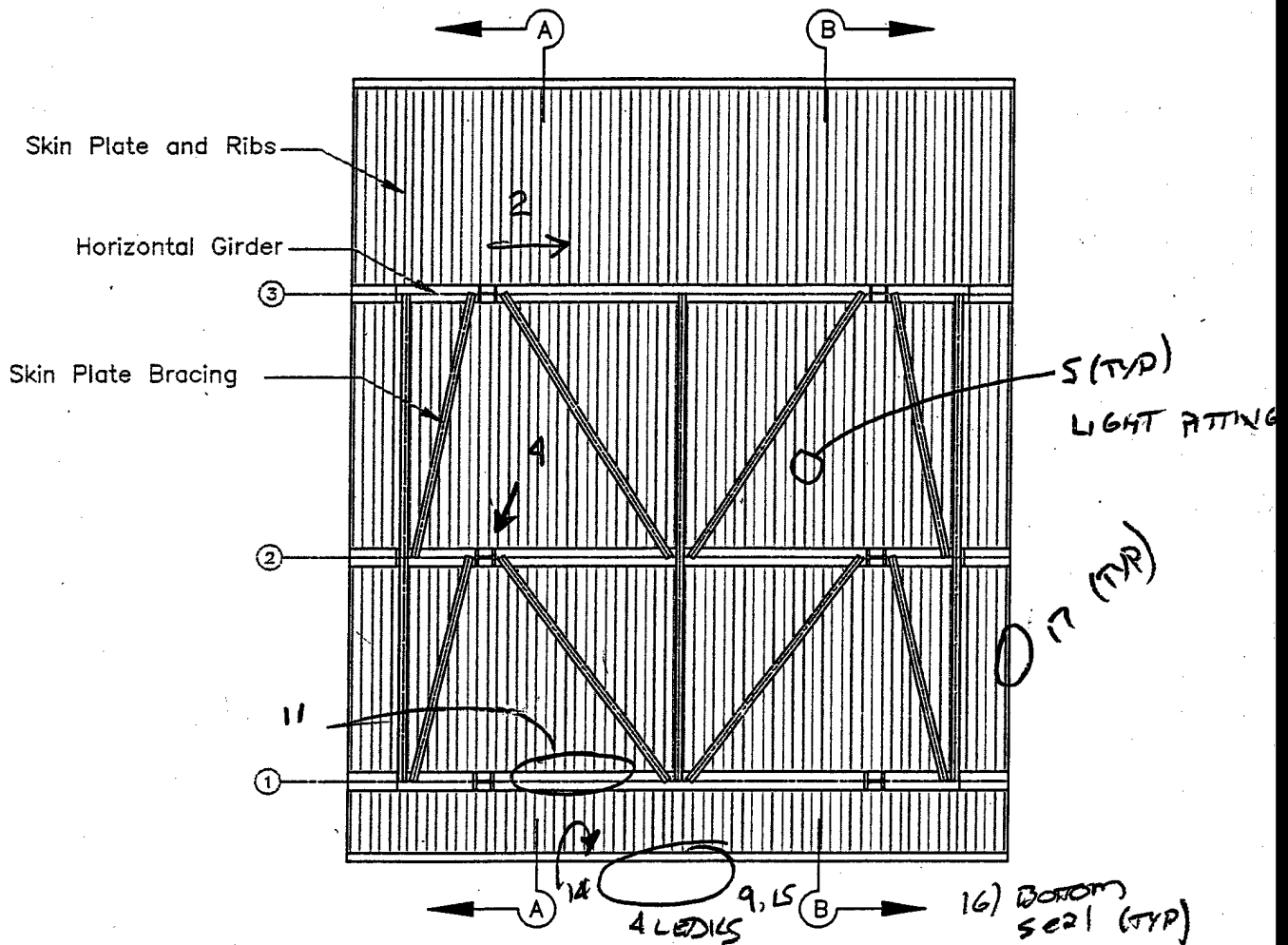
Gate No. 6
Right Elevation A-A



Member	Type	Depth d		Web t _w		Flange(s)			
		Plan (in)	Measured (in)	Plan (in)	Measured (in)	Plan (in)	Measured (in)	Plan (in)	Measured (in)
Strut 3	14 WF 202	15 5/8	15 5/8	15/16	—	15 3/4	15 3/4	1 1/2	1 1/2
Strut 2	14 WF 342	17 1/2	17 3/8	1 9/16	—	16 3/8	16 1/8	2 7/16	2 1/2
Strut 1	14 WF 398	18 1/4	18 1/4	1 13/16	—	16 5/8	16 3/8	2 13/16	2 13/16
Brace A	14 WF 30	13 7/8	14 7/16	5/16	5/16	6 3/4	6 7/8	3/8	3/8
Brace B	14 WF 30	13 7/8	14 1/16	5/16	5/16	6 3/4	7	3/8	3/8
Brace C	14 WF 30	13 7/8	14	5/16	5/16	6 3/4	6 15/16	3/8	3/8
Brace D	14 WF 30	13 7/8	14	5/16	5/16	6 3/4	7	3/8	3/8
Brace E	14 WF 30	13 7/8	13 7/8	5/16	5/16	6 3/4	7	3/8	3/8
Brace F	14 WF 30	13 7/8	14	5/16	5/16	6 3/4	6 7/8	3/8	3/8
Brace G	14 WF 30	13 7/8	14	5/16	5/16	6 3/4	6 7/8	3/8	3/8
Brace H	14 WF 30	13 7/8	14	5/16	5/16	6 3/4	7	3/8	3/8
Brace J	14 WF 30	13 7/8	14	5/16	5/16	6 3/4	6 7/8	3/8	3/8
Brace K	14 WF 30	13 7/8	13 5/16	5/16	5/16	6 3/4	7	3/8	3/8
Brace L	14 WF 30	13 7/8	14	5/16	5/16	6 3/4	6 7/8	3/8	3/8
Brace M	14 WF 30	13 7/8	13 7/8	5/16	5/16	6 3/4	6 15/16	3/8	3/8
Brace N	14 WF 30	13 7/8	13 7/8	5/16	5/16	6 3/4	7	3/8	3/8

10) STANDING WATER, CLOGGED DRAIN

Gate No. 6 Downstream Elevation



Member	Type	Depth d		Web t _w		Flange - End			
		Plan (in)	Measured (in)	Plan (in)	Measured (in)	Plan (in)	Measured (in)	Plan (in)	Measured (in)
Horiz. Girder 3	PL Girder	49 3/4	50 1/16	7/16	15/32	16	16	7/8	7/8
Horiz. Girder 2	PL Girder	60 1/2	60 9/16	3/4	3/4	16 1/2	16 1/2	1 1/4	1 5/16
Horiz. Girder 1	PL Girder	60 1/2	60 1/2	1	1	16 1/2	16 1/2	1 1/4	1 5/16
Purlins	ST 10 WF 31	10 1/2	10 7/16	13/32	→	8 1/4	8 1/4	5/8	5/8
Skin PL Bracing	ST 7 WF 15	7	7	1/4	1/4	6 3/4	6 2/8	3/8	3/8

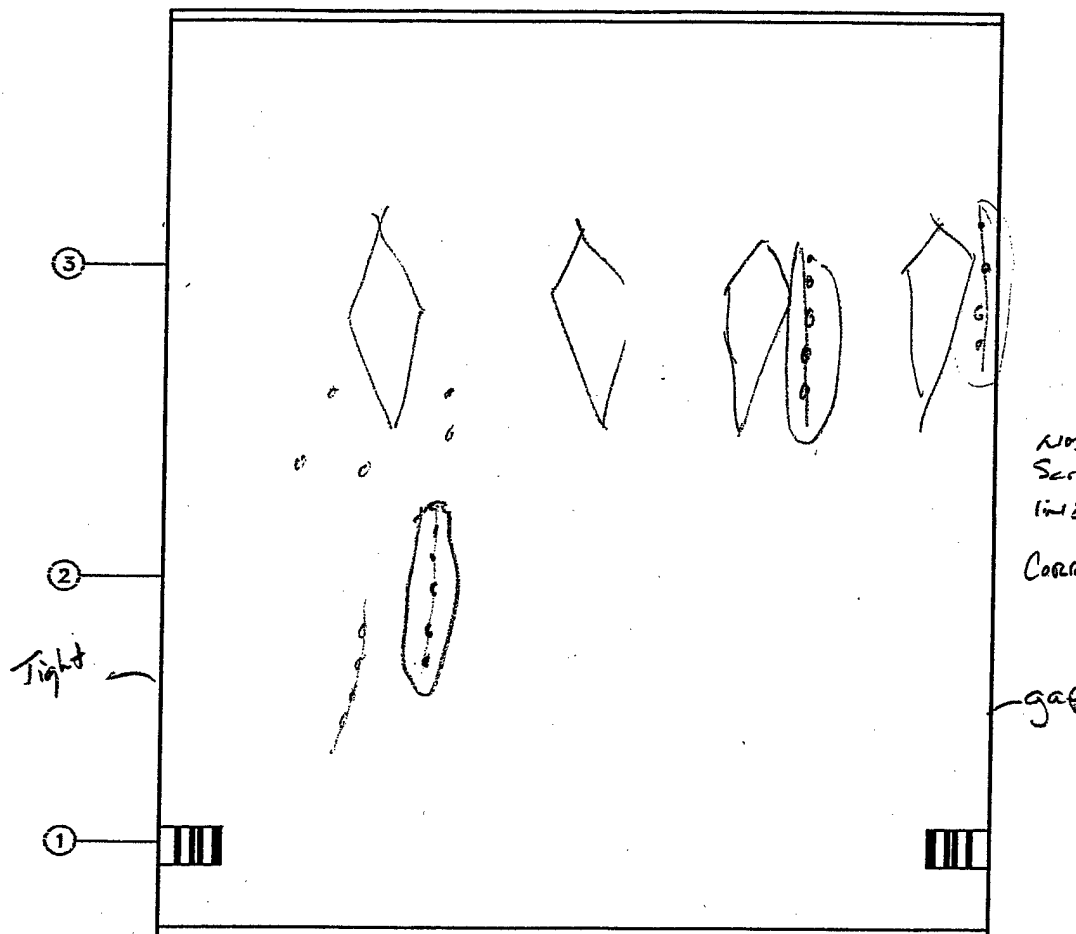
2) TOP HORIZ (TYP) EVID. POST STANDING WATER

4) DS FLANGE, LIGHT COR, EVID STANDING WATER

11) EVIDENCE CLOGGED DRAIN/ STANDING WATER

16) STANDING WATER (TYP)

Gate No. 6 Upstream Elevation



NOTE: THERE appears to be
Scratches along Corrosion
lines.

Corr. Varies from $\frac{1}{8}$ " to $\frac{1}{4}$ "

① Gate DV. ID.

② Ponding @ Bottom of Gate

③ Bottom Seal

④ Bottom Seal Gate L → R

⑤ Water ponding

- the gate is tight on LEFT SIDE no/a gap on Right SIDE.

Gate No. 6 Operation and Trunnion Measurements

Racking Measurements: Bottom of Gate and Spillway

LEFT
30 1/4

RIGHT
30 1/4

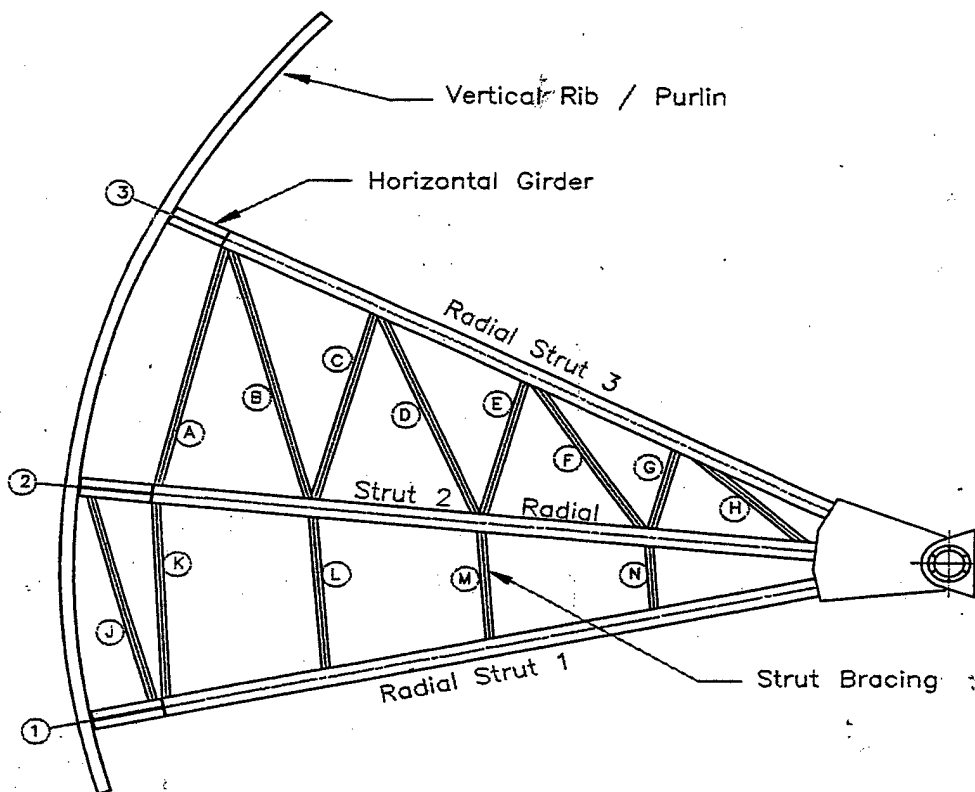
Transverse Trunnion Hub Movement, No Load on Gate: Closed-Open-Closed

	LEFT		RIGHT	
	Inside	Outside (pier)	Inside	Outside (pier)
Initial Gate Closed	30/32	16/32	21/32	23/32
Gate Full Open	30/32	16/32	20/32	23/32
Final Gate Closed	30/32	16/32	21/32	23/32

3-D Trunnion Hub Movements - Unloaded vs. Loaded

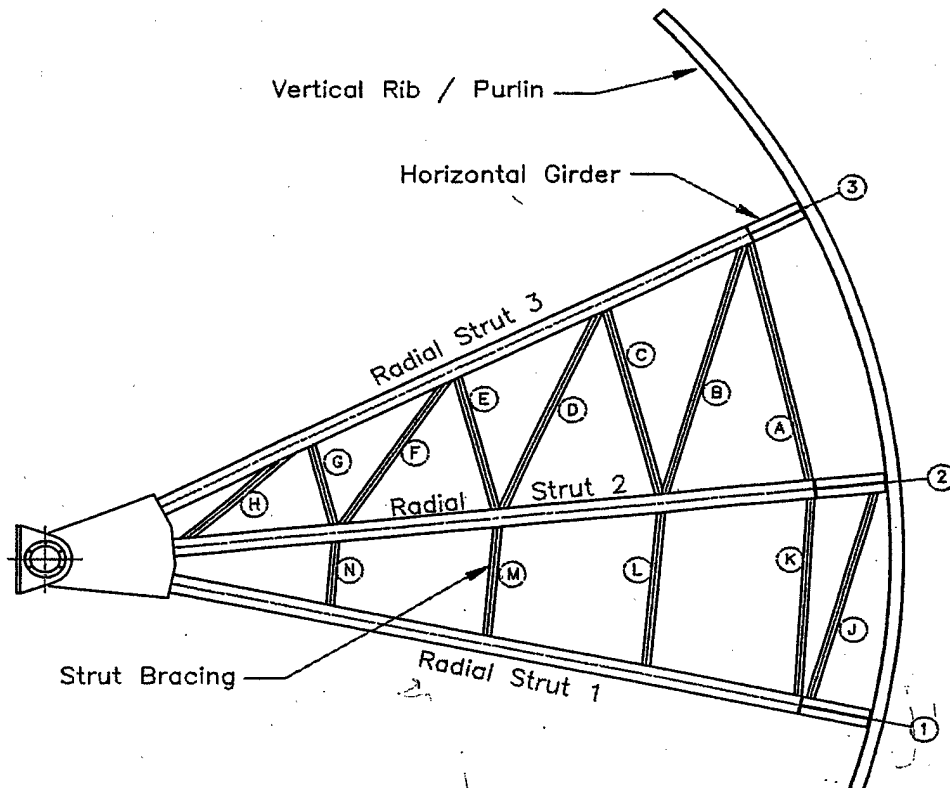
	LEFT				RIGHT			
	No Load Void Dry		Full Load Void Full		No Load Void Dry		Full Load Void Full	
Vertical	-0.0005		-0.0095					
US / DS	-0.0005		+0.0350					
Transverse	30/32	16/32	30/32	16/32	21/32	23/32	21/32	23/32
	Inside	Outside	Inside	Outside	Inside	Outside	Inside	Outside

Gate No. 7
Left Elevation B-B



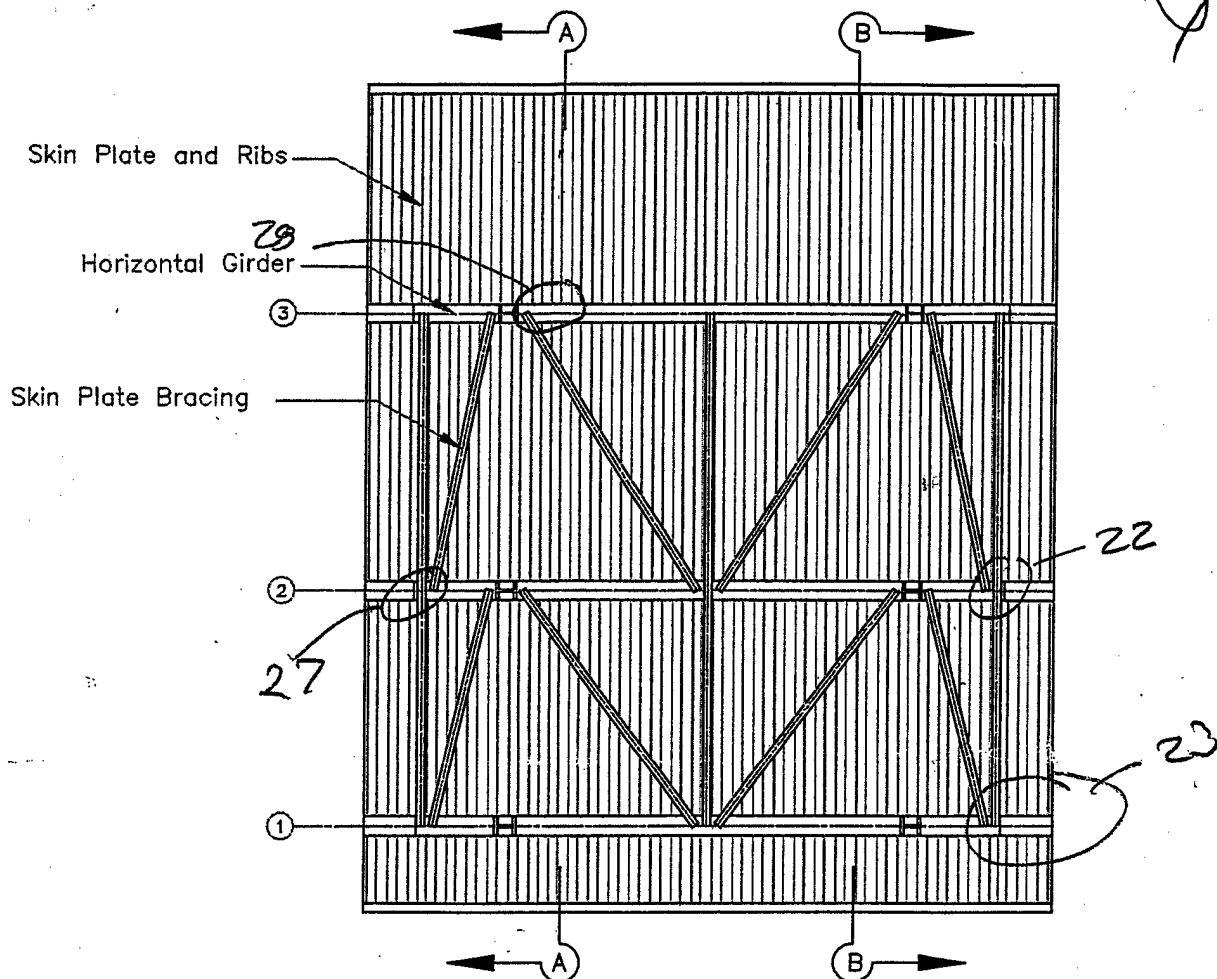
Member	Type	Depth d		Web t _w		Flange(s)			
		Plan (in)	Measured (in)	Plan (in)	Measured (in)	Plan (in)	Measured (in)	Plan (in)	Measured (in)
Strut 3	14 WF 202	15 5/8	15 5/8	15/16		15 3/4	15 5/8	1 1/2	1 1/2
Strut 2	14 WF 342	17 1/2	17 7/16	1 9/16		16 3/8	16 3/16	2 7/16	2 7/16
Strut 1	14 WF 398	18 1/4	18 1/4	1 13/16		16 5/8	16 3/16	2 13/16	2 7/8
Brace A	14 WF 30	13 7/8	14	5/16		6 3/4	6 7/8	3/8	3/8
Brace B	14 WF 30	13 7/8	14 1/16	5/16		6 3/4	6 7/8	3/8	3/8
Brace C	14 WF 30	13 7/8	14	5/16		6 3/4	6 3/4	3/8	3/8
Brace D	14 WF 30	13 7/8	14 1/16	5/16		6 3/4	6 12/16	3/8	3/8
Brace E	14 WF 30	13 7/8	13 15/16	5/16		6 3/4	6 7/8	3/8	3/8
Brace F	14 WF 30	13 7/8	13 5/16	5/16		6 3/4	6 13/16	3/8	3/8
Brace G	14 WF 30	13 7/8	13 1/16	5/16		6 3/4	6 3/4	3/8	3/8
Brace H	14 WF 30	13 7/8	14	5/16		6 3/4	6 3/4	3/8	3/8
Brace J	14 WF 30	13 7/8	14 1/16	5/16		6 3/4	6 3/4	3/8	7/16
Brace K	14 WF 30	13 7/8	13 1/16	5/16		6 3/4	6 3/4	3/8	3/8
Brace L	14 WF 30	13 7/8	13 1/16	5/16		6 3/4	6 3/4	3/8	3/8
Brace M	14 WF 30	13 7/8	13 15/16	5/16		6 3/4	6 7/8	3/8	3/8
Brace N	14 WF 30	13 7/8	14	5/16		6 3/4	6 3/4	3/8	3/8

Gate No. 7
Right Elevation A-A



Member	Type	Depth d		Web t _w		Flange(s)			
		Plan (in)	Measured (in)	Plan (in)	Measured (in)	Plan (in)	Measured (in)	Plan (in)	Measured (in)
Strut 3	14 WF 202	15 5/8	15 5/8	15/16		15 3/4	15 1/8	1 1/2	1 1/2
Strut 2	14 WF 342	17 1/2	17 1/2	1 9/16		16 3/8	16 1/16	2 7/16	2 1/2
Strut 1	14 WF 398	18 1/4	18 1/4	1 13/16		16 5/8	16 3/16	2 13/16	2 1/16
Brace A	14 WF 30	13 7/8	13 5/16	5/16		6 3/4	6 3/4	3/8	3/8
Brace B	14 WF 30	13 7/8	13 5/16	5/16		6 3/4	6 13/16	3/8	3/8
Brace C	14 WF 30	13 7/8	13 5/16	5/16		6 3/4	6 13/16	3/8	3/8
Brace D	14 WF 30	13 7/8	13 1/16	5/16		6 3/4	6 7/8	3/8	3/8
Brace E	14 WF 30	13 7/8	13 1/16	5/16		6 3/4	6 7/8	3/8	3/8
Brace F	14 WF 30	13 7/8	13 1/16	5/16		6 3/4	6 13/16	3/8	3/8
Brace G	14 WF 30	13 7/8	13 1/16	5/16		6 3/4	6 3/4	3/8	3/8
Brace H	14 WF 30	13 7/8	13 1/16	5/16		6 3/4	6 13/16	3/8	3/8
Brace J	14 WF 30	13 7/8	13 1/16	5/16		6 3/4	6 3/4	3/8	3/8
Brace K	14 WF 30	13 7/8	13 1/16	5/16		6 3/4	6 3/4	3/8	3/8
Brace L	14 WF 30	13 7/8	13 1/16	5/16		6 3/4	6 3/4	3/8	3/8
Brace M	14 WF 30	13 7/8	13 1/16	5/16		6 3/4	6 3/4	3/8	3/8
Brace N	14 WF 30	13 7/8	13 1/16	5/16		6 3/4	6 3/4	3/8	3/8

Gate No. 7 Downstream Elevation



Member	Type	Depth		Web		Flange - End			
		Plan	Measured	Plan	Measured	Plan	Measured	Plan	Measured
		(in)	(in)	(in)	(in)	(in)	(in)	(in)	(in)
Horiz. Girder 3	PL Girder	49 3/4	49 13/16	7/16	7 1/16	16	16	7/8	7 1/8
Horiz. Girder 2	PL Girder	60 1/2	60 1/2	3/4	3 1/4	16 1/2	16 1/2	1 1/4	1 1/4
Horiz. Girder 1	PL Girder	60 1/2	60 1/4	1		16 1/2	16 1/2	1 1/4	1 1/4
Purlins	ST 10 WF 31	10 1/2	10 1/2	13/32		8 1/4	8 1/4	5/8	5/8
Skin PL Bracing	ST 7 WF 15	7	7	1/4	1/4	6 3/4	6 3/4	3/8	3/8

22. Brace plates @ 2nd strut to girder. NOT WELDED @ back of GIRDER (Typ.)

23. EVIDENCE OF STANDING H₂O / Debris

24. STANDING H₂O AND MUCK IN BOT. SEAL P/L.

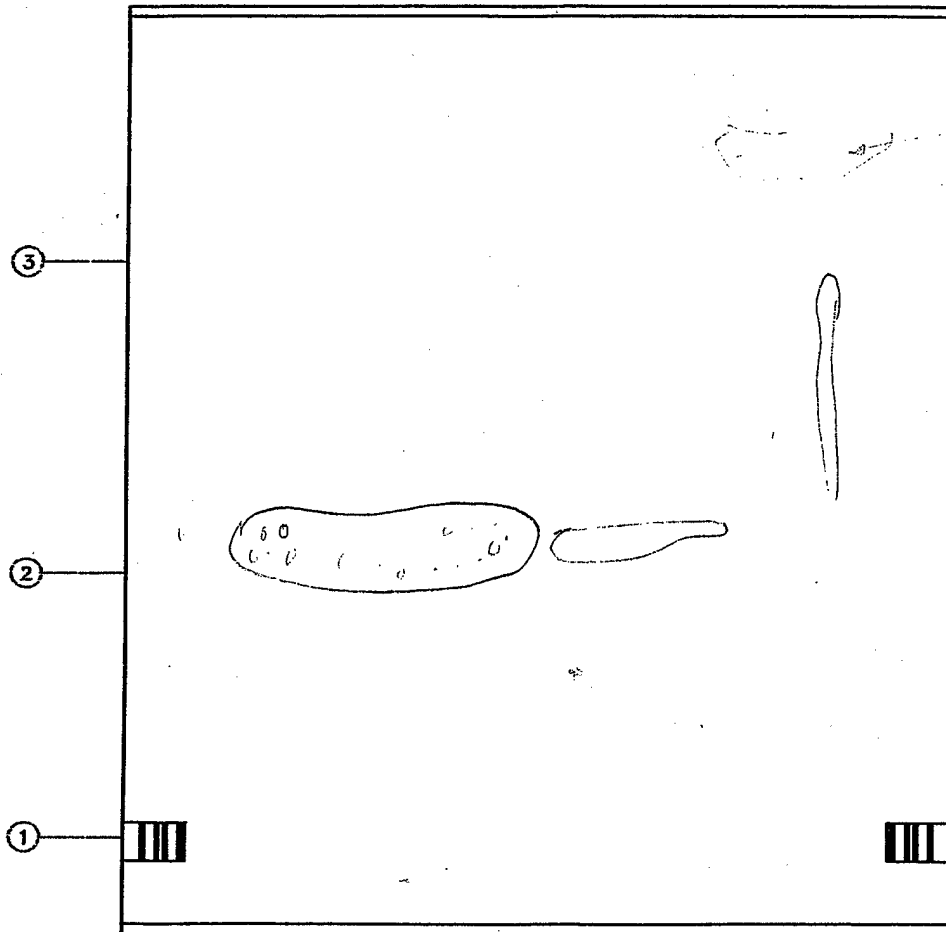
25. LEAKS ALONG BOT. SEAL

26. Bot. LFT. STRUT @ Bot Girder Light Rust

27. BENT WEB OF T beam

28. Light Rust & Delam. P/L.

Gate No. 7 Upstream Elevation _____



- Erosion pits are in groups. $\frac{1}{2}$ - $\frac{1}{4}$ " Deep
- Cables on left side: High Vibrations
- Bottom 3rd pits are every $1\frac{1}{2}$ - 2' on ave.

Gate No. 7 Operation and Trunnion Measurements

Racking Measurements: Bottom of Gate and Spillway

LEFT
24 3/4

RIGHT
24 3/4

Transverse Trunnion Hub Movement, No Load on Gate: Closed-Open-Closed

	LEFT	
	Inside	Outside (pier)
Initial Gate Closed	28/32	20/32
Gate Full Open	28/32	20/32
Final Gate Closed	28/32	20/32

	RIGHT	
	Inside	Outside (pier)
Initial Gate Closed	22/32	17/32
Gate Full Open	22/32	17/32
Final Gate Closed	22/32	17/32

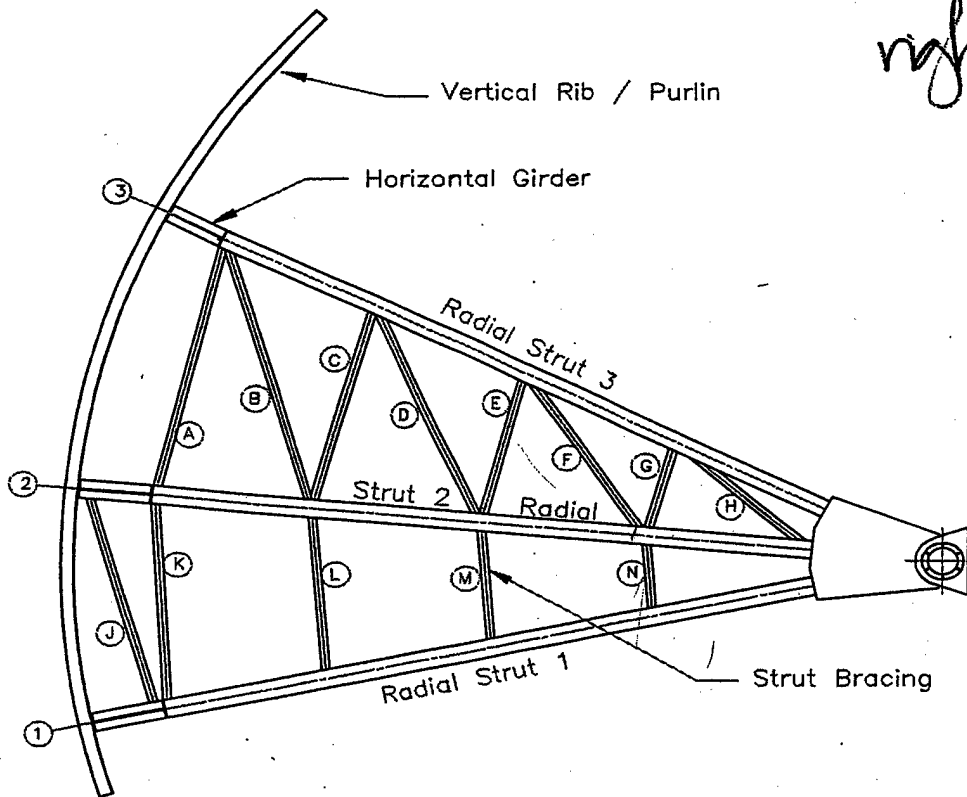
3-D Trunnion Hub Movements - Unloaded vs. Loaded

	LEFT			
	No Load Void Dry		Full Load Void Full	
Vertical	+0.0023		+0.0075	
US / DS	-0.0005		+0.0340	
Transverse	28/32	20/32	28/32	20/32
	Inside	Outside	Inside	Outside

	RIGHT			
	No Load Void Dry		Full Load Void Full	
Vertical				
US / DS				
Transverse	22/32	17/32	22/32	17/32
	Inside	Outside	Inside	Outside

HEAVY VIBRATION & HAMMER \approx 18'-19' OPEN

BOTTOM GIRDER, RIGHT SIDE APPEARS TO BE
DRAGGING ON PIER

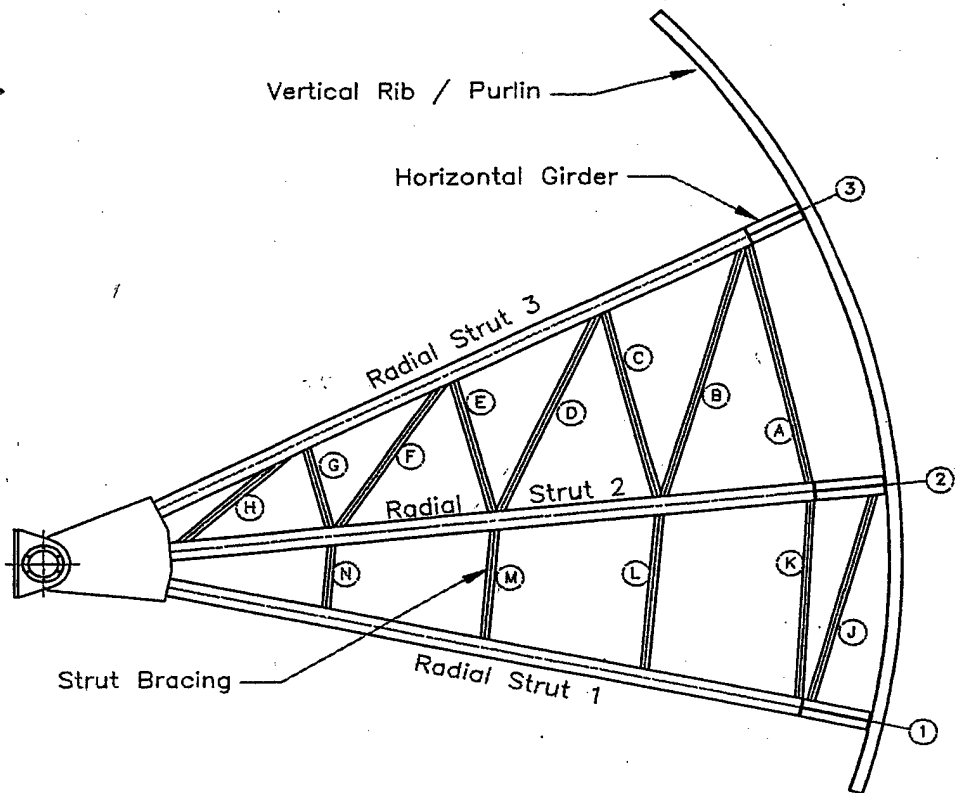


right. Gate No. 8
~~Left Elevation B-B~~
A-A.

Member	Type	Depth d		Web t _w		Flange(s)			
		Plan (in)	Measured (in)	Plan (in)	Measured (in)	Plan (in)	Measured (in)	Plan (in)	Measured (in)
Strut 3	14 WF 202	15 5/8	✓ 15 3/8	15/16	—	15 3/4	✓	1 1/2	✓
Strut 2	14 WF 342	17 1/2	✓ 17 3/8	1 9/16	—	16 3/8	✓ 16 3/8	2 7/16	✓
Strut 1	14 WF 398	18 1/4	✓ 18 3/4	1 13/16	—	16 5/8	✓ 16 5/8	2 13/16	✓
Brace A	14 WF 30	13 7/8	✓ 14	5/16	—	6 3/4	✓	3/8	✓
Brace B	14 WF 30	13 7/8	✓ 14	5/16	—	6 3/4	✓	3/8	✓
Brace C	14 WF 30	13 7/8	✓ 14	5/16	—	6 3/4	✓ 6 3/4	3/8	✓
Brace D	14 WF 30	13 7/8	✓ 14	5/16	—	6 3/4	✓	3/8	✓
Brace E	14 WF 30	13 7/8	✓ 14	5/16	—	6 3/4	✓	3/8	✓
Brace F	14 WF 30	13 7/8	✓ 14	5/16	—	6 3/4	✓	3/8	✓
Brace G	14 WF 30	13 7/8	✓ 14	5/16	—	6 3/4	✓	3/8	✓
Brace H	14 WF 30	13 7/8	✓ 14	5/16	—	6 3/4	✓	3/8	✓
Brace J	14 WF 30	13 7/8	✓ 14 1/2	5/16	—	6 3/4	✓ 6 3/4	3/8	✓
Brace K	14 WF 30	13 7/8	✓ 14	5/16	—	6 3/4	✓	3/8	✓
Brace L	14 WF 30	13 7/8	✓ 14	5/16	—	6 3/4	✓ 6 3/4	3/8	✓
Brace M	14 WF 30	13 7/8	✓ 14	5/16	—	6 3/4	✓	3/8	✓
Brace N	14 WF 30	13 7/8	✓ 14	5/16	—	6 3/4	✓	3/8	✓

④ cable slots, left, dry

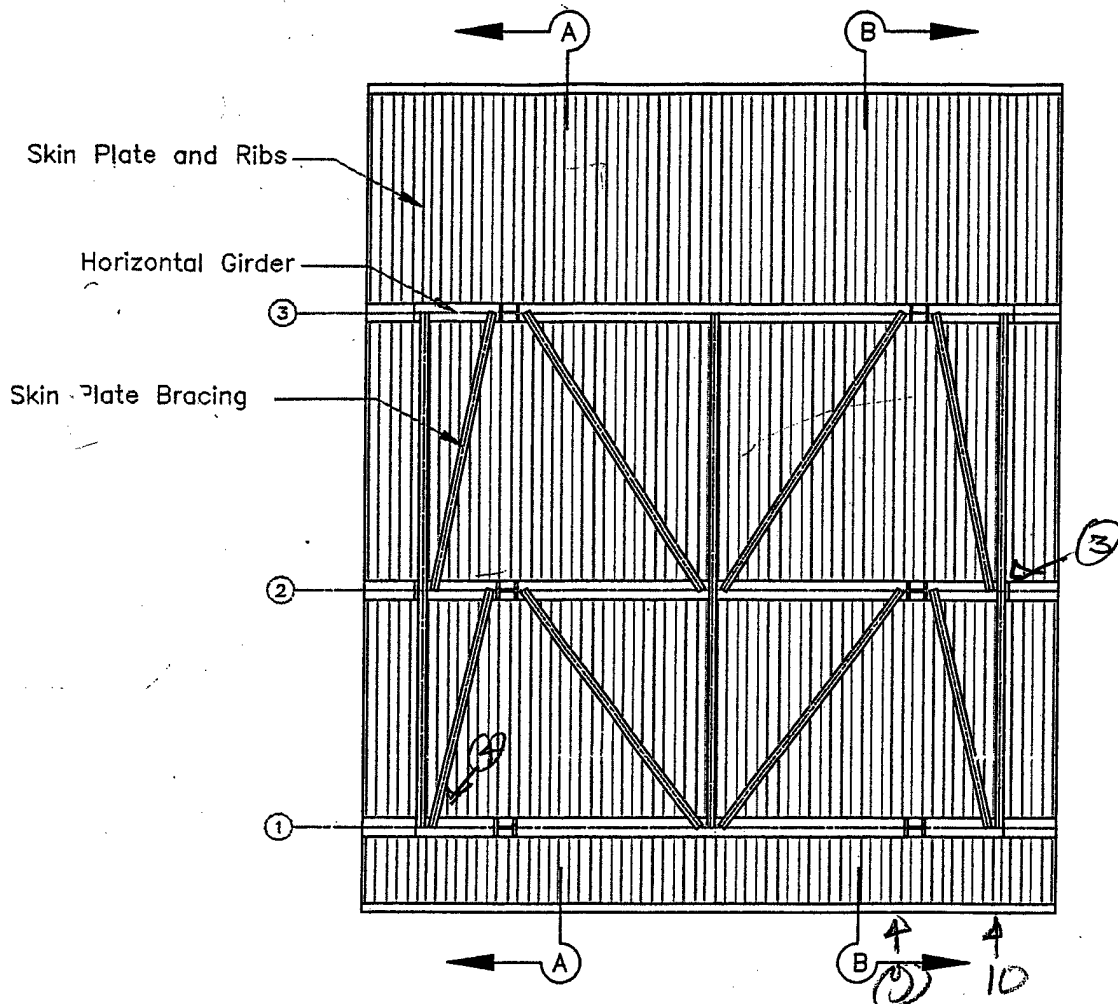
Gate No. 8
~~Right Elevation AA~~
Left BB



Member	Type	Depth d		Web t _w		Flange(s)			
		Plan (in)	Measured (in)	Plan (in)	Measured (in)	Plan (in)	Measured (in)	Plan (in)	Measured (in)
Strut 3	14 WF 202	15 5/8	✓	15/16	✓	15 3/4	✓	1 1/2	✓
Strut 2	14 WF 342	17 1/2	✓	1 9/16	✓	16 3/8	✓	2 7/16	✓
Strut 1	14 WF 398	18 1/4	✓	1 13/16	✓	16 5/8	✓	2 13/16	✓
Brace A	14 WF 30	13 7/8	✓	5/16	✓	6 3/4	✓	3/8	✓
Brace B	14 WF 30	13 7/8	✓	5/16	✓	6 3/4	✓	3/8	✓
Brace C	14 WF 30	13 7/8	✓	5/16	✓	6 3/4	✓	3/8	✓
Brace D	14 WF 30	13 7/8	✓	5/16	✓	6 3/4	✓	3/8	✓
Brace E	14 WF 30	13 7/8	✓	5/16	✓	6 3/4	✓	3/8	✓
Brace F	14 WF 30	13 7/8	✓	5/16	✓	6 3/4	✓	3/8	✓
Brace G	14 WF 30	13 7/8	✓	5/16	✓	6 3/4	✓	3/8	✓
Brace H	14 WF 30	13 7/8	✓	5/16	✓	6 3/4	✓	3/8	✓
Brace J	14 WF 30	13 7/8	✓	5/16	✓	6 3/4	✓	3/8	✓
Brace K	14 WF 30	13 7/8	✓	5/16	✓	6 3/4	✓	3/8	✓
Brace L	14 WF 30	13 7/8	✓	5/16	✓	6 3/4	✓	3/8	✓
Brace M	14 WF 30	13 7/8	✓	5/16	✓	6 3/4	✓	3/8	✓
Brace N	14 WF 30	13 7/8	✓	5/16	✓	6 3/4	✓	3/8	✓

- (15) Left side seal, ponding water, leak, bottom.
- (16) Purlin on second girder, pitting, top
- (17) Gate face on second girder, pitting, top
- (18) Left trunnion, top strut, corrosion, before
- (19) after, light corrosion
- (20) Overall gate face

Gate No. 3 Downstream Elevation



Member	Type	Depth		Web		Flange - End			
		Plan (in)	Measured (in)	Plan (in)	Measured (in)	Plan (in)	Measured (in)	Plan (in)	Measured (in)
Horiz. Girder 3	PL Girder	49 3/4	✓	7/16	✓	16	✓	7/8	✓
Horiz. Girder 2	PL Girder	60 1/2	✓	3/4	✓	16 1/2	✓	1 1/4	✓
Horiz. Girder 1	PL Girder	60 1/2	✓	1	✓	16 1/2	✓	1 1/4	✓
Purlins	ST 10 WF 31	10 1/2	✓	13/32	✓	8 1/4	8 1/8	5/8	✓
Skin PL Bracing	ST 7 WF 15	7	✓	1/4	5/16	6 3/4	6 13/16	3/8	✓

③ Ponding in Second girder, no corrosion

④ Leak on left

⑤ Side Seals, right. look good.

⑥ Leak in bottom seal, left side

⑦ Ponding water in bottom seal

⑧ Ponding water, right, bottom girder, cable slots

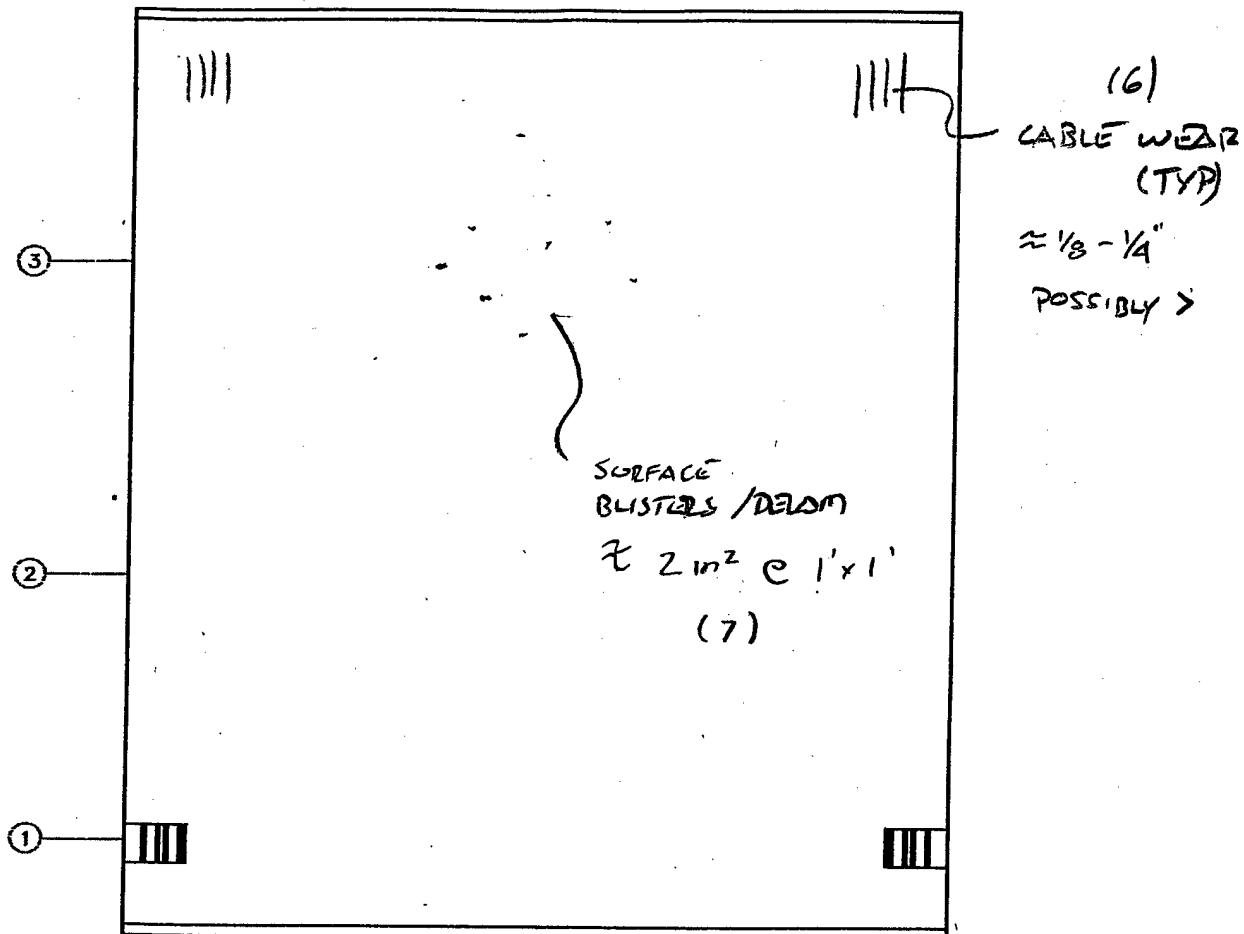
⑨ Leak in bottom seal

⑩ Leak in bottom seal, by pier

⑪ middle leak.

⑫ Leak in bottom seal, - left.

Gate No. 8 Upstream Elevation



DEEP PITTING UP TO $1/4$ " AT TOP

Gate No. 8 Operation and Trunnion Measurements

Racking Measurements: Bottom of Gate and Spillway

LEFT	RIGHT
26	25 3/8

Transverse Trunnion Hub Movement, No Load on Gate: Closed-Open-Closed

	LEFT		RIGHT	
	Inside	Outside (pier)	Inside	Outside (pier)
Initial Gate Closed	14/32	30/32	17/32	26/32
Gate Full Open	14/32	30/32	17/32	26/32
Final Gate Closed	14/32	30/32	17/32	26/32

3-D Trunnion Hub Movements - Unloaded vs. Loaded

	LEFT				RIGHT			
	No Load Void Dry		Full Load Void Full		No Load Void Dry		Full Load Void Full	
Vertical	0.0000		-0.0030					
US / DS	+0.0010		+0.0240					
Transverse	14/32	30/32	14/32	30/32	17/32	26/32	17/32	26/32
	Inside	Outside	Inside	Outside	Inside	Outside	Inside	Outside

Date 10/04/00
Sheet 1 OF 1

Hoist Amperage Readings

Name Plate Data	WESTINGHOUSE	
Horsepower	15	
Voltage	460/3 PHASE/60 HZ	DESIGN C
Current	19.50	1760 RPM
Type	71D14371	
Frame	254T	

Amperage		Loaded		Unloaded	
		Opening	Closing	Opening	Closing
Starting		112.0	110.0		
Running	Phase A	16.1	9.6		
	Phase B	16.0	9.6		
	Phase C	15.8	8.9		

UNABLE TO DO UNLOADED DUE TO FISH MITAGATION

Hoist Amperage Readings

Name Plate Data	WESTINGHOUSE	
Horsepower	15	
Voltage	460/3 PHASE/60 HZ	DESIGN C
Current	19.50	1760 RPM
Type	71D14371	
Frame	254T	

Amperage		Loaded		Unloaded	
		Opening	Closing	Opening	Closing
Starting		108.0	104.5	106.0	102.0
Running	Phase A	15.2	9.9	13.5	9.0
	Phase B	15.7	10.6	14.6	9.2
	Phase C	14.9	9.7	14.1	10

RIGHT ANGLE GEAR BOX NOISY

Gate No. 3

Hoist Amperage Readings

Name Plate Data WESTINGHOUSE

Horsepower 15

Voltage 460/3 PHASE/60 HZ DESIGN C

Current 19.50 1760 RPM

Type 71D14371

Frame 254T

Amperage		Loaded		Unloaded	
		Opening	Closing	Opening	Closing
Starting		117.6	114.4	114.4	111.2
Running	Phase A	16.1	10.1	15.5	10.6
	Phase B	16.3	11.2	15.5	10.5
	Phase C	16.6	10.4	15.8	10.6

PRIMARY WORMGEAR REDUCER NOISY (SOUNDS DRY)

MAIN REDUCER HAS SEVERE LEAK (@ OUTPUT SHAFT ODE)

ODE (OPPOSITE DRIVE END)

HDR Engineering, Inc.
Corp of Engineers - Walla Walla
Lower Granite Dam

Inspection Team K & N
Weather CLEAR

Date 10/08/00
Sheet 1 OF 1

Gate No. 4

Hoist Amperage Readings

Name Plate Data WESTINGHOUSE

Horsepower	15
-------------------	-----------

Voltage	460/3 PHASE/60 HZ	DESIGN C
----------------	--------------------------	-----------------

Current	<u>19.50</u>	<u>1760 RPM</u>
----------------	--------------	-----------------

Type 71D14371

Frame 254T

Amperage		Loaded		Unloaded	
		Opening	Closing	Opening	Closing
Starting		116.2	104.8	112.0	105.0
Running	Phase A	15.5	9.6	16.2	10.2
	Phase B	16.1	9.7	15.3	10.0
	Phase C	15.6	9.4	16.3	10.5

SIMILAR LEAKS TO UNITS 3

BEARING NOISE MOTOR SHAFT SIDE

Gate No. 5

Hoist Amperage Readings

Name Plate Data WESTINGHOUSE

Horsepower 15

Voltage 460/3 PHASE/60 HZ DESIGN C

Current 19.50 1760 RPM

Type 71D14371

Frame 254T

Amperage		Loaded		Unloaded	
		Opening	Closing	Opening	Closing
Starting		108.8	112.0	115.0	111.2
Running	Phase A	15.0	9.6	14.1	10.1
	Phase B	15.9	10.5	14.7	10.1
	Phase C	16.9	10.2	14.7	10.4

SAME LUBE LEAKS & SEEPAGE AS OTHER UNITS
OUTPUT SHAFT SEAL LEAKING DRIVE SHAFT SIDE

HDR Engineering, Inc.
Corp of Engineers - Walla Walla
Lower Granite Dam

Inspection Team K & N

Weather CLEAR

Date 10/03/00

Sheet 1 OF 1

Gate No. 6

Hoist Amperage Readings

Name Plate Data WESTINGHOUSE

Horsepower 15

Voltage 460/3 PHASE/60 HZ DESIGN C

Current 19.50 1760 RPM

Type 71D14371

Frame 254T

Amperage		Loaded		Unloaded	
		Opening	Closing	Opening	Closing
Starting		113.6	106.4	110.5	110.0
Running	Phase A	15.3	10.2	15.2	10.6
	Phase B	15.9	10.2	15.1	9.3
	Phase C	15.8	10.1	16.3	9.8

TYPICAL LUBRICANT SEEPAGE TO OTHER UNITS

Date 10/04/00
Sheet 1 OF 1

Hoist Amperage Readings

Name Plate Data	WESTINGHOUSE	
Horsepower	15	
Voltage	460/3 PHASE/60 HZ	DESIGN C
Current	19.50	1760 RPM
Type	71D14371	
Frame	254T	

Amperage		Loaded		Unloaded	
		Opening	Closing	Opening	Closing
Starting		116.8	110.8	124.1	110.0
Running	Phase A	15.6	10.1	15.1	9.4
	Phase B	15.3	10.0	16.2	9.9
	Phase C	15.7	9.6	16.0	8.9

NORMAL LUBE LEAKAGE

[illegible]

Hoist Amperage Readings

Name Plate Data	WESTINGHOUSE	
Horsepower	15	
Voltage	460/3 PHASE/60 HZ	DESIGN C
Current	19.50	1760 RPM
Type	71D14371	
Frame	254T	

Amperage		Loaded		Unloaded	
		Opening	Closing	Opening	Closing
Starting		114.0	108.0	110.4	110.6
Running	Phase A	15.3	10.4	16.3	10.9
	Phase B	16.0	9.8	14.8	10.1
	Phase C	15.7	9.8	14.8	10.

LUBE SEEPAGE @ MOST BEARING, COUPLING LOCATIONS

LARGE LEAK @ REDUCER OUTPUT SHAFT ODE W/BUILDUP ON DECK

**KLEINFELDER***An employee owned company*

Ultrasonic Testing Technique Report Steel Group

Client Name: HDR Engineering
Project Name: Walla Walla Lower Granite Dam
Contractor: HDR Engineering
Technique Performed By: Destry K. Hall

UT Report No.: 1
Date: October 2, 2000
KA Project No.: 21-6149-01-001
Client Contact: Wayne Edwards
Level: 2

Type of Inspection (check one): Straight Beam ☐ Angle Beam ☒ Other ☒
If other please specify: Evaluation of moment resisting frames.

Drawings Referenced: Walla Walla District Corps of Engineers, Draft Scope Outline, Radial Gate Inspection, Analysis and Testing, Lower Granite Dam.

Equipment: Krautkramer Branson USN 52L s/n: 00D94J Date of Calibration: 4/26/00

Transducer: SWS, Gamma, 2.25 X .75 X .625, BNC s/n: 00CM4P : Wedge, SF-AWS, 70 DEG. s/n: 00D0JB

Test Block: IIW, Type 1, Steel : s/n: 7856 / DSC, Steel : s/n: 98-6331

Method Used: Procedure # 1, Top quarter 70°, Middle half 70°, Bottom quarter 70°, Face A and Face B when possible

Scanning Method: Pattern E w/ A, B and C movement Scanning Level: 20 dB above Zero Reference.

Material Type: ASTM A36 / ASTM A572

Temp. of Material: Ambient Sensitivity Level: 80% FSH Surface Condition: Tight adhering paint

Examination Standard: ASTM E 164-94 Acceptance Standard: AWS D1.5-95 NDT Procedure No.: KA-NDETP-UT-001

Quality requirements - section no. : AWS D1.5-98 Section # 9.21.3 and Table 9.1; and Section 9 Part C

Weld joint AWS: TC-U5-GF, TC-U4b-GF, B-U4b-GF, B-U5-GF Welding process : GMAW / FCAW / SMAW

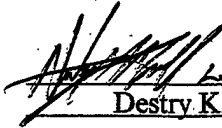
Material Thickness : 3/4 through 1-5/8

Weld identification: Each weld was identified on drawings by HDR Representative Sam Planck; All testing was performed for information only.

CERTIFICATION PAPERS ARE AVAILABLE UPON REQUEST.

We, the undersigned, certify that the statements in this record are correct and that the welds were prepared and tested in accordance with the requirements of ANSI/AASHTO/AWS D1.5 (1995) Bridge Welding Code.
year

Kleinfelder, Inc.

Inspector Signature: 

Inspector Name: Destry K. Hall

Page 1 of 10.

**KLEINFELDER***An employee owned company***ULTRASONIC TEST REPORT**

CLIENT NAME HDR Engineering
 PROJECT NAME Walla Walla; Lower Granite Dam
 CONTRACTOR C.O.E
 GATE NO.: 1 through 8

DATE: 10-2/10-13/00
 PROJECT NO.: 21-6149-01
 UT REPORT NO.: 001
 PAGE 2 OF 10

REPORT OF ULTRASONIC TESTING OF MATERIALS

COUPLANT	Ultragel II	INSTRUMENT SN#:	00D94J	JOINT DESCRIPTION:	
CAL BLOCK SN#	IIW (7856)	REFERENCE LEVEL:	48 Db	BUTT JOINT:	B-U4b-GF / B-U5-GF
TRANSDUCER SN#	00CM4P	SCANNING LEVEL:	+20 Db	CORNER JOINT:	TC-U5-GF
ANGLE/MODE:	70 & 60 deg.	SURFACE CONDITION:	Painted	T-JOINT:	TC-U4b-GF
ACCEPT CRITERIA AWS TBL:	9.1	MATERIAL THICKNESS:	3/4" / 1-5/8"	COMMENTS: Welding process used: SMAW/GMAW/FCAW. Tested through painted surface. Information only.	
EXAMINATION FROM FACE:	A & B	VOLUMETRIC EXAM IN LEG:			
ZERO DEGREE TRANSDUCER:		DIAMETER: 1"	FREQUENCY: 2.25 Mhz		

ITEMS EXAMINED / TESTED: 3-strut arm splices and center strut mid-span splice
 ITEM DESIGNATION: Gate 1, Gate 2, Gate 3, Gate 4, Gate 5, Gate 6, Gate 7 and Gate 8
Strut 1(a), Strut 2(a), Strut 3(a), Trunnion (a), Strut 1(b), Strut 2(b), Strut 3(b) and Trunnion (b),

WELD IDENTIFICATION	ACCEPTED	REJECTED	REMARKS
1. Gate 1	41	3	
2. Gate 2	42	2	
3. Gate 3	37	7	
4. Gate 4	27	17	
5. Gate 5	41	3	
6. Gate 6	41	3	
7. Gate 7	29	15	
8. Gate 8	40	4	
9.			
10.			

TOTAL WELDS TESTED: 352
 TOTAL WELDS ACCEPTED: 298
 TOTAL WELDS REJECTED: 54

COMMENTS and/or SKETCH:

5%

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ULTRASONIC TEST REPORT

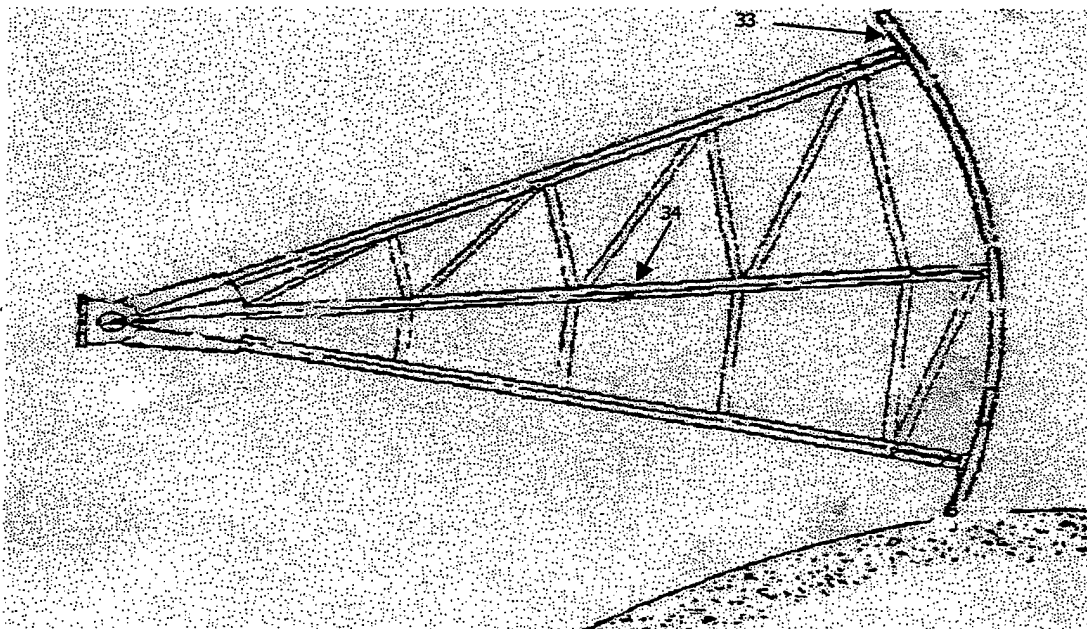
GATE 1

PROJECT NAME Walla Walla; Lower Granite Dam
PROJECT NO.: 21-6149-01

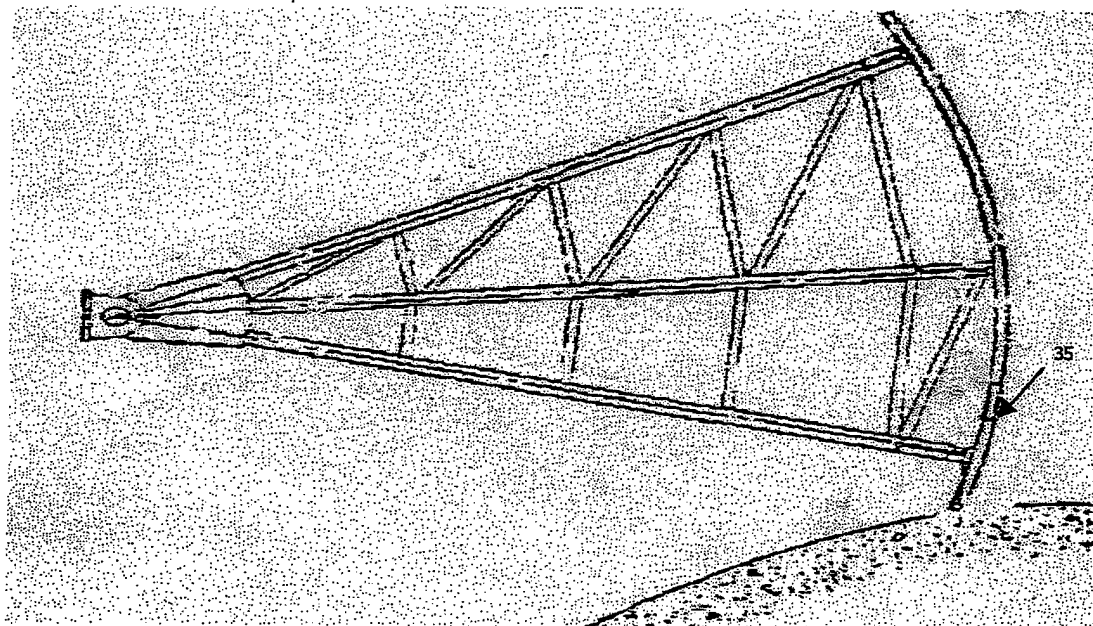
DATE: 10-2/10-13/00
PAGE 3 of 10

INFORMATION ON REJECTED WELDS

LINE NUMBER	INDICATION NUMBER	TRANSDUCER ANGLE	FROM FACE	LEG°	DECIBALS				DISCONTINUITY				Discontinuity Evaluation	Remarks	
					Indication Level	Reference Level	Attenuation Factor	Indication Rating	Length	Angular Distance (Sound Path)	Depth from "A" Surface	DISTANCE			
												From X			From Y
1	336	70	A	1 & 2	52dB	48 Db	.562	3.438	1.25	1.281	.832			B	
2	346	70	A	1 & 2	54dB	48 Db	2.794	3.206	2.625	2.397	1.296			B	
3	356	70	A	1 & 2	49dB	48 Db	1.594	-.594		1.797	1.034			A	
4															
5															
6															
7															
8															
9															
10															
11															
12															
13															
14															
15															
16															
17															
18															
19															
20															



GATE 1 (Outer Left)



GATE 1 (Inner Right)

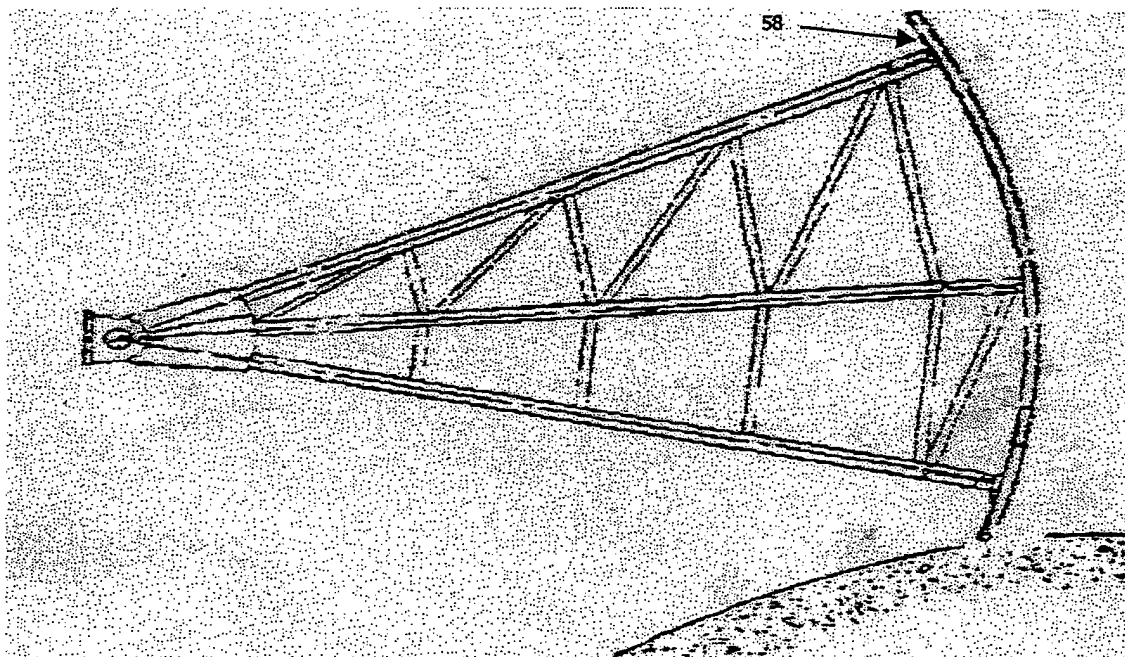
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ULTRASONIC TEST REPORT

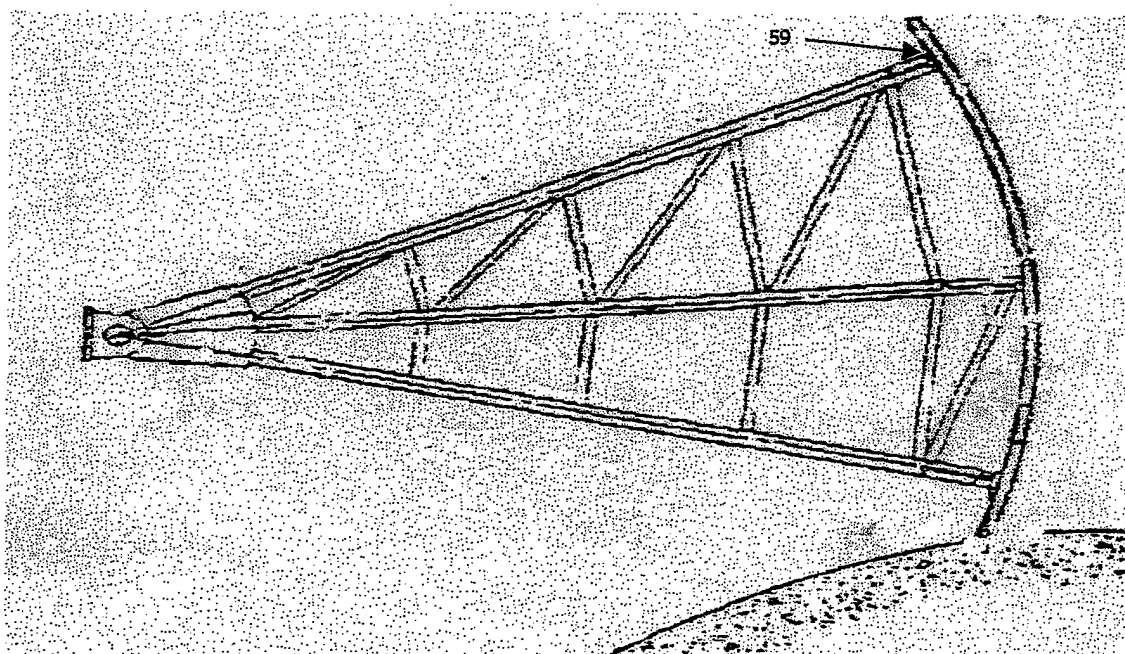
GATE 2

PROJECT NAME Walla Walla; Lower Granite Dam
PROJECT NO.: 21-6149-01DATE: 10-2/10-13/00
PAGE 4 of 10**INFORMATION ON REJECTED WELDS**

LINE NUMBER	INDICATION NUMBER	TRANSDUCER ANGLE	FROM FACE	LEG°	DECIBALS				DISCONTINUITY				Discontinuity Evaluation	Remarks	
					Indication Level	Reference Level	Attenuation Factor	Indication Rating	Length	Angular Distance (Sound Path)	Depth from "A" Surface	DISTANCE			
												From X			From Y
1	58fo	70	A	1 + 2	48db	48db	5.016	-5.016		3.508	1.200			A	
2	59fo	70	A	1 + 2	52dB	48db	4.886	-886		3.443	1.178			A	
3															
4															
5															
6															
7															
8															
9															
10															
11															
12															
13															
14															
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19															
20															



GATE 2 (Outer Left)



GATE 2 (Inner Right)

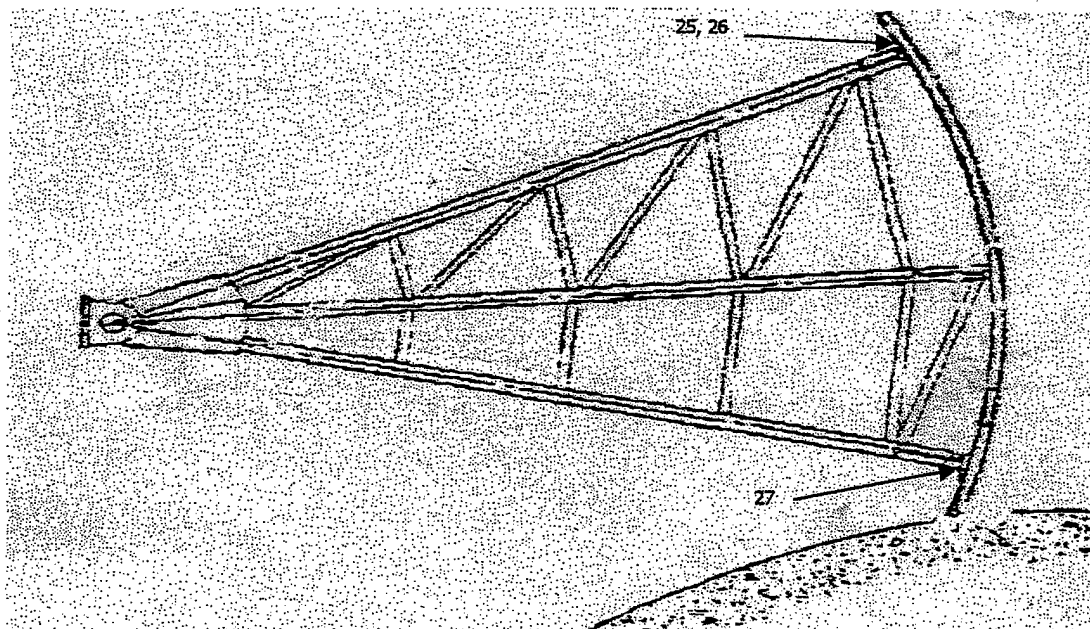
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ULTRASONIC TEST REPORT

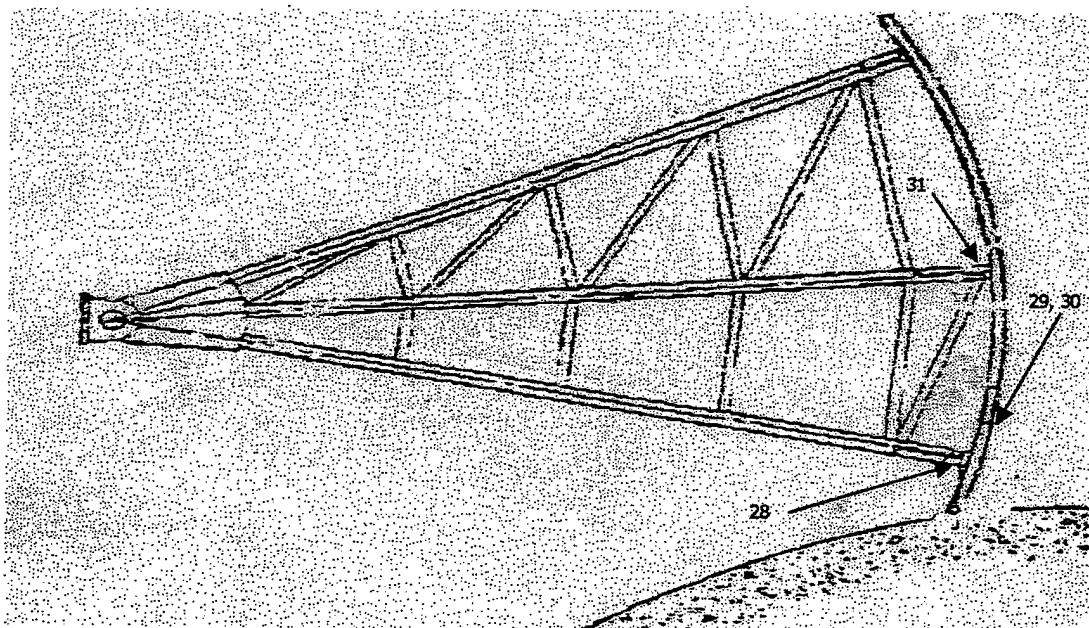
GATE 3

PROJECT NAME: Walla Walla; Lower Granite Dam
PROJECT NO.: 21-6149-01DATE: 10-2/10-13/00
PAGE: 5 of 10**INFORMATION ON REJECTED WELDS**

LINE NUMBER	INDICATION NUMBER	TRANSDUCER ANGLE	FROM FACE	LEG	DECIBELS				DISCONTINUITY				Discontinuity Evaluation	Remarks	
					Indication Level	Reference Level	Attenuation Factor	Indication Rating	Length	Angular Distance (Sound Path)	Depth from "A" Surface	DISTANCE			
												From X			From Y
1	25f	70	A	1 & 2	50dB	48 Db	1.014	.986		1.507	.758			A	
2	26w	70	A	1 & 2	54dB	48 Db	4.35	1.65		3.175	1.034			A	
3	27f	70	A	1 & 2	52dB	48 Db	4.048	1.048		3.024	1.234			A	
4	28f	70	A	1 & 2	48dB	48 Db	1.268	1.268		1.634	.978			A	
5	29f	70	A	1 & 2	50dB	48 Db	1.718	.282		1.859	.937			A	
6	30f	70	A	1 & 2	54dB	48 Db	3.014	2.98	1.125	2.507	.878			B	
7	31w	70	A	1 & 2	54dB	48 Db	3.906	2.094	1.875	2.253	1.178			A	
8							3.906	2.094							
9															
10															
11															
12															
13															
14															
15															
16															
17															
18															
19															
20															



GATE 3 (Outer Left)



GATE 3 (Inner Right)

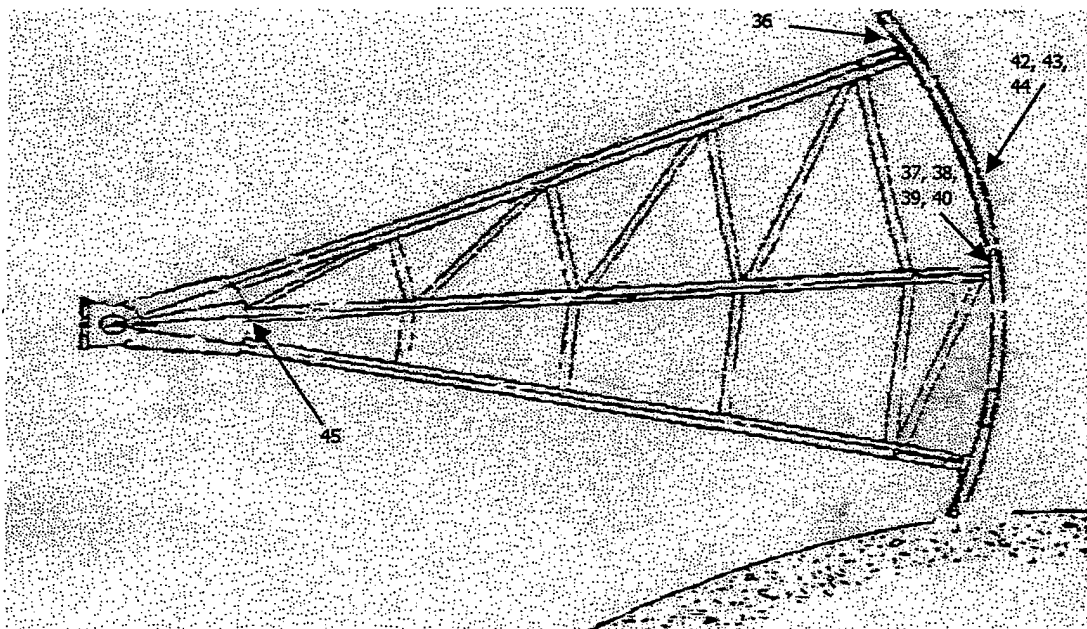
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ULTRASONIC TEST REPORT

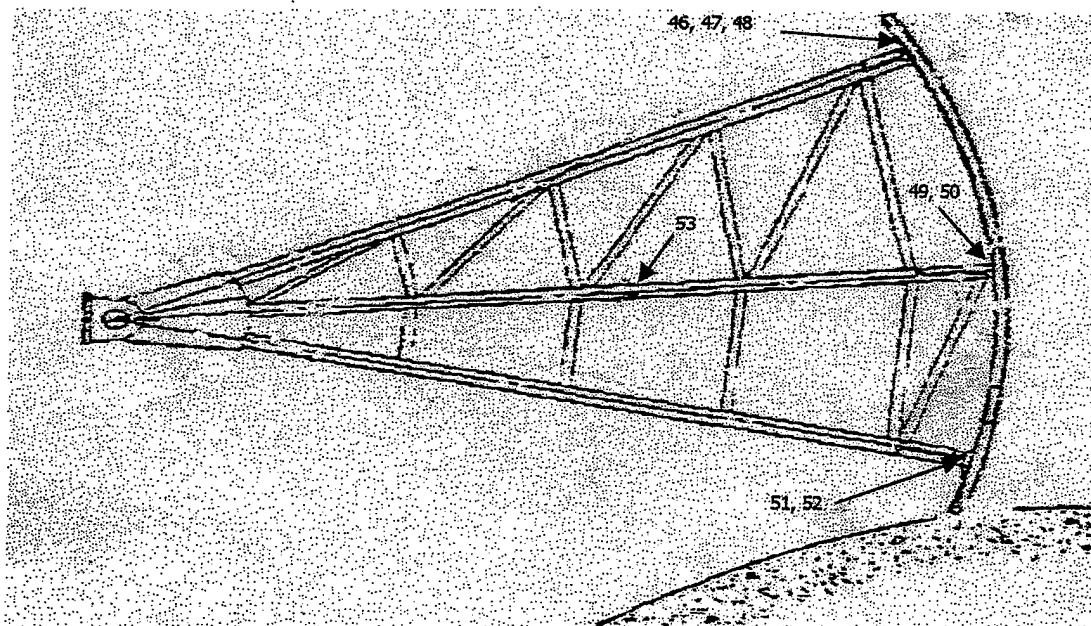
GATE 4

PROJECT NAME Walla Walla; Lower Granite Dam
PROJECT NO.: 21-6149-01DATE: 10-2/10-13/00
PAGE 6 of 10**INFORMATION ON REJECTED WELDS**

LINE NUMBER	INDICATION NUMBER	TRANSDUCER ANGLE	FROM FACE	LEG°	DECIBALS				DISCONTINUITY				Discontinuity Evaluation	Remarks	
					Indication Level	Reference Level	Attenuation Factor	Indication Rating	Length	Angular Distance (Sound Path)	Depth from "A" Surface	DISTANCE			
												From X			From Y
1	36w	70	A	1 + 2	54dB	48dB	3.906	2.094		2.953	1.010			A	
2	37fo	70	A	1 + 2	54dB	48dB	.802	6.802	1.5	.599	.205			D	Acceptable
3	38fi	70	A	1 + 2	54dB	48dB	5.01	.99		3.505	1.198			A	
4	39fi	70	A	1 + 2	54dB	48dB	4.35	1.65		3.175	1.086			A	
5	40fi	70	A	1 + 2	54dB	48dB	4.542	1.458		3.271	1.119			A	
6	42fo	70	A	1 + 2	54dB	48dB	-.404	6.404	3.5"	.798	.272			D	Acceptable
7	43w	70	A	1 + 2	54dB	48dB	.562	5.438	2.5"	1.281	.438			D	Acceptable
8	44fi	70	A	1 + 2	50dB	48dB	-.294	2.294	.375"	.853	.285			A	
9	45w	70	A	1 + 2	54dB	48dB	2.542	3.458	.375"	2.271	.777			B	Acceptable by length
10	46fo	70	A	1 + 2	48dB	48dB	5.582	-5.582		3.791	1.296			A	
11	47fi	70	A	1 + 2	54dB	48dB	2.794	3.206	.875"	2.397	.820			B	
12	48w	70	A	1 + 2	50dB	48dB	3.014	-1.014		2.507	.857			A	
13	49fo	70	A	1 + 2	49dB	48dB	-.406	1.406		.797	.272			A	HAZ
14	50fo	70	A	1 + 2	48dB	48dB	.026	-.026		1.013	.346			A	HAZ
15	51fo	70	A	1 + 2	48dB	48dB	1.706	.294		1.853	.375			A	ind. out of gate, 60%fsh
16	52fi	70	A	1 + 2	49dB	48dB	5.788	-4.788		3.894	1.331			A	
17	53fo	70	A	1 + 2	48dB	48dB	4.158	-4.158		3.079	1.053			A	
18															
19															
20															



GATE 4 (Outer Left)



GATE 4 (Inner Right)

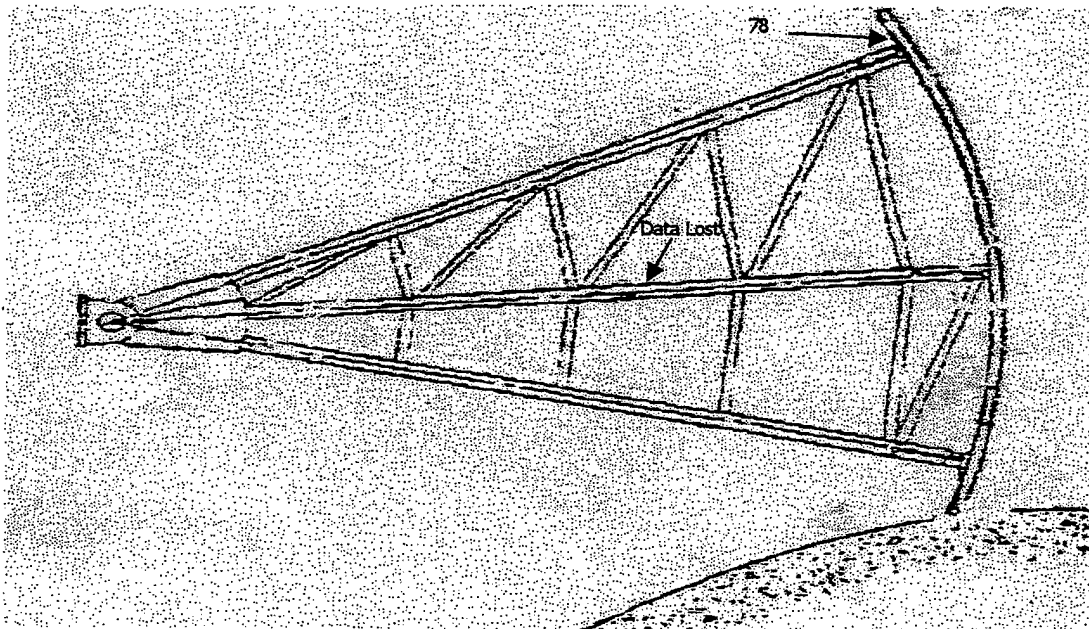
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ULTRASONIC TEST REPORT

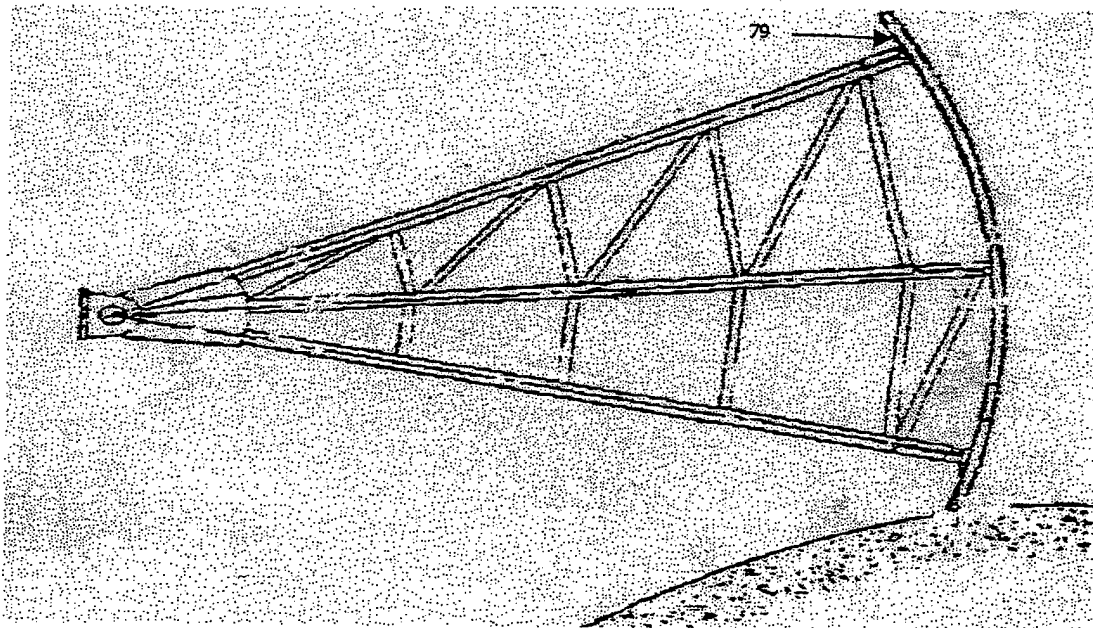
GATE 5

PROJECT NAME Walla Walla; Lower Granite Dam
PROJECT NO.: 21-6149-01DATE: 10-2/10-13/00
PAGE 7 of 10**INFORMATION ON REJECTED WELDS**

LINE NUMBER	INDICATION NUMBER	TRANSDUCER ANGLE	FROM FACE	LEG	DECIBALS				DISCONTINUITY				Discontinuity Evaluation	Remarks	
					Indication Level	Reference Level	Attenuation Factor	Indication Rating	Length	Angular Distance (Sound Path)	Depth from "A" Surface	DISTANCE			
												From X			From Y
1	78fi	70	A	1 + 2	50dB	48dB	3.118	-1.118	3.5"	2.559	.857			A	
2	79fi	70	A	1 + 2	52dB	48dB	2.652	1.348	.850	2.326	.855			A	no data loged
3	80fi	70	A	1 + 2	52dB	48dB	4.084	-.084		3.024	1.034			A	
4															
5															
6															
7															
8															
9															
10															
11															
12															
13															
14															
15															
16															
17															
18															
19															
20															



GATE 5 (Outer Left)



GATE 5 (Inner Right)

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ULTRASONIC TEST REPORT

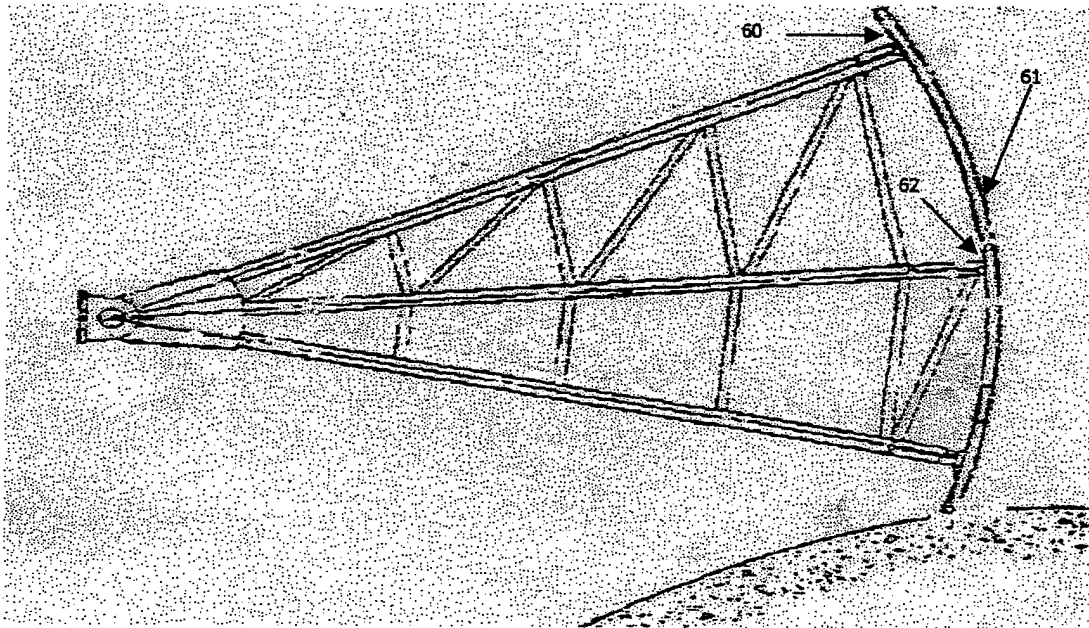
GATE 6

PROJECT NAME Walla Walla; Lower Granite Dam
PROJECT NO.: 21-6149-01

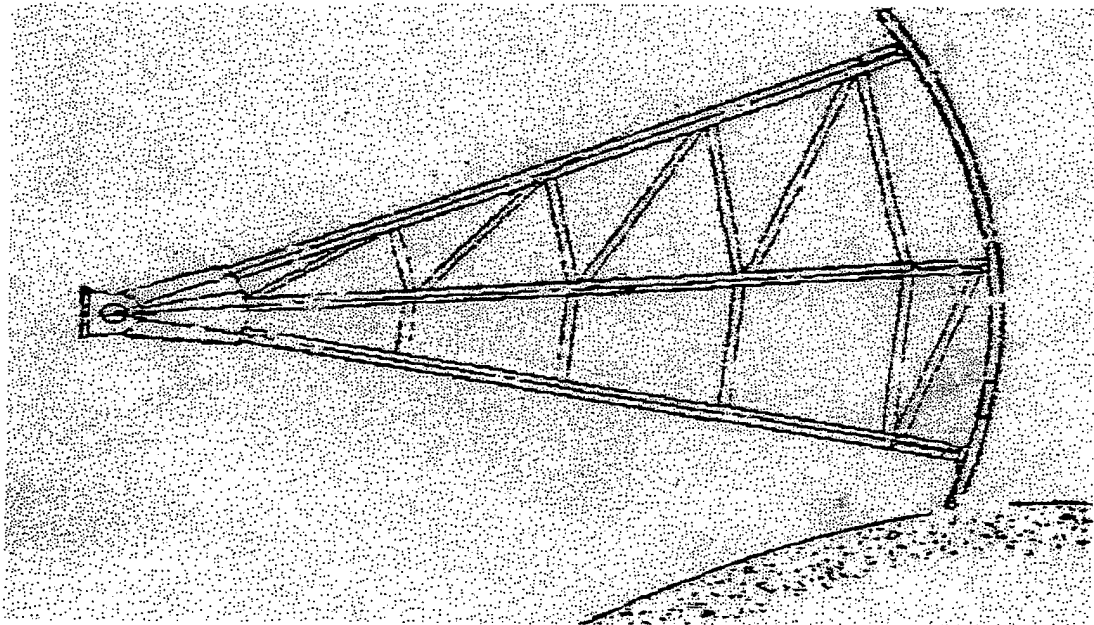
DATE: 10-2/10-13/00
PAGE 8 of 10

INFORMATION ON REJECTED WELDS

LINE NUMBER	INDICATION NUMBER	TRANSDUCER ANGLE	FROM FACE	LEG	DECIBALS				DISCONTINUITY				Discontinuity Evaluation	Remarks	
					Indication Level	Reference Level	Attenuation Factor	Indication Rating	Length	Angular Distance (Sound Path)	Depth from "A" Surface	DISTANCE			
												From X			From Y
1	60fo	70	A	1 + 2	48dB	48dB	1.67	-1.67	2.75"	1.835	.897			A	no data logged
2	61fo	70	A	1 + 2	50dB	48dB	-.272	2.272	full	.864	.295			B	
3	62fi	70	A	1 + 2	50dB	48dB	4.67	-2.67	3.5"	3.335	1.141			A	
4															
5															
6															
7															
8															
9															
10															
11															
12															
13															
14															
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16															
17															
18															
19															
20															



GATE 6 (Inner Right)



GATE 6 (Outer Left)

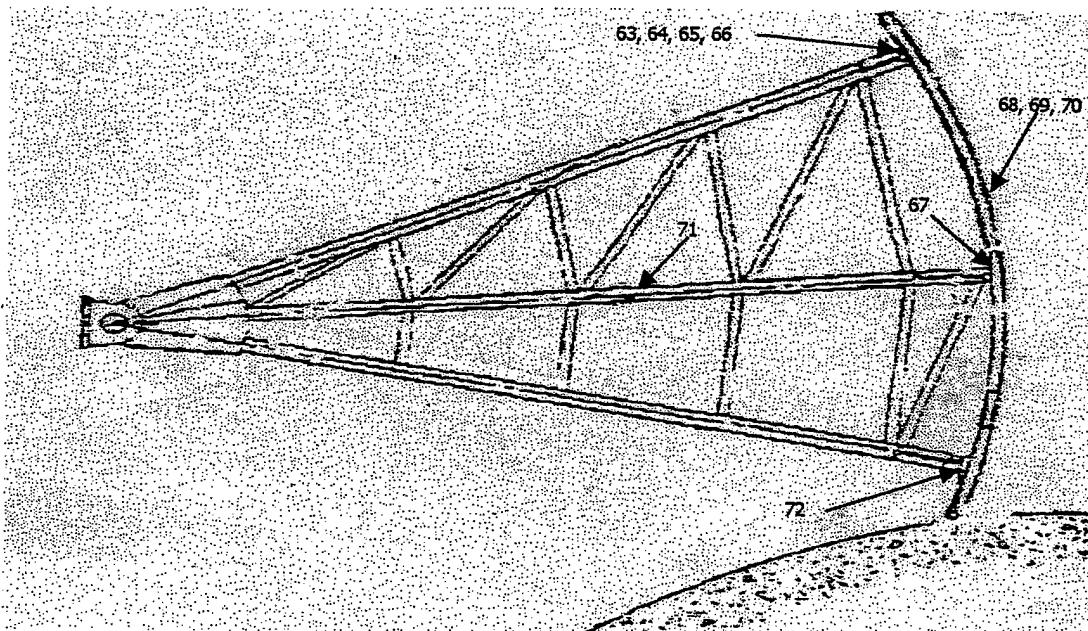
**KLEINFELDER***An employee owned company*

ULTRASONIC TEST REPORT

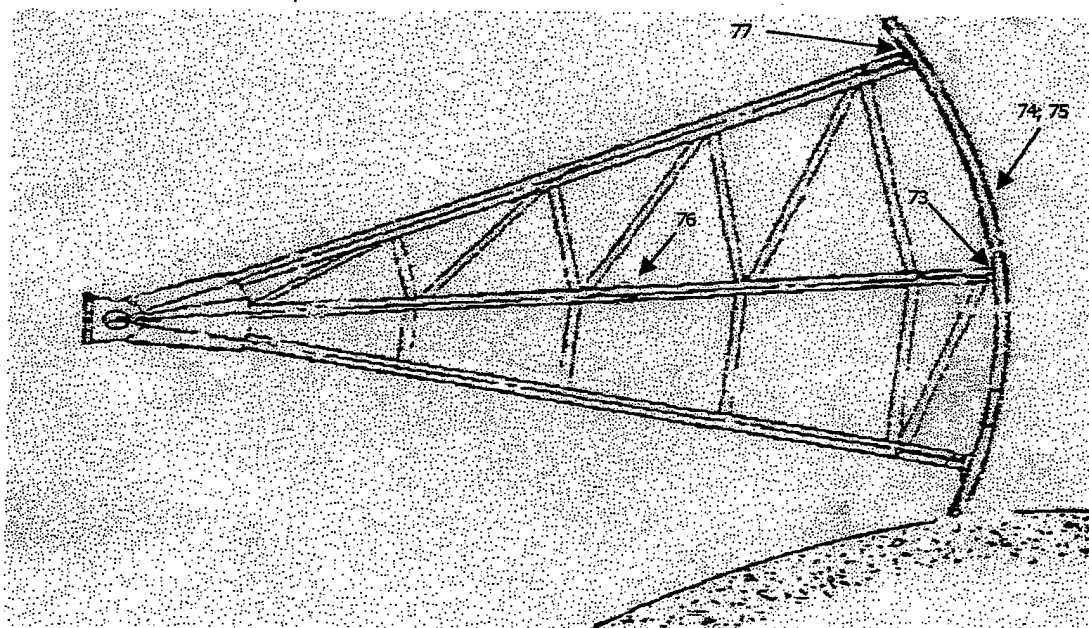
GATE 7

PROJECT NAME Walla Walla; Lower Granite Dam
PROJECT NO.: 21-6149-01DATE: 10-2/10-13/00
PAGE 9 of 10**INFORMATION ON REJECTED WELDS**

INFORMATION ON REJECTED WELDS															
LINE NUMBER	INDICATION NUMBER	TRANSDUCER ANGLE	FROM FACE	LEG°	DECIBALS				DISCONTINUITY				Discontinuity Evaluation	Remarks	
					Indication Level	Reference Level	Attenuation Factor	Indication Rating	Length	Angular Distance (Sound Path)	Depth from "A" Surface	DISTANCE			
												From X			From Y
1	63fo	70	A	1 + 2	48dB	48dB	5.664	-5.664		3.832	1.310			A	
2	64fo	70	A	1 + 2		48dB									no data logged
3	65fi	70	A	1 + 2	48dB	48dB	5.944	-5.944		3.972	1.343			A	
4	66w	70	A	1 + 2	48dB	48dB	4.694	-4.694		3.347	1.144			A	
5	67fi	70	A	1 + 2	48dB	48dB	4.416	1.584		3.308	1.131			A	
6	68fi	70	A	1 + 2	48dB	48dB	-.118	.118		.941	.322			A	
7	69w	70	A	1 + 2	44dB	48dB	-.608	-3.392		.696	.238			A	
8	70fo	70	A	1 + 2	49dB	48dB	-.312	1.312		.844	.298			A	
9	71fi	70	A	1 + 2		48dB									no data logged
10	72fo	70	A	1 + 2	48dB	48dB	1.298	-1.298		1.649	.564			A	
11	73fi	70	A	1 + 2		48dB									no data logged
12	74w	70	A	1 + 2	48dB	48dB	-.704	.704		.648	.222			A	
13	75fo	70	A	1 + 2	48dB	48dB	-.256	.256		.872	.298			A	
14	76w	70	A	1 + 2	48dB	48dB	.734	-.734		1.367	.467			A	
15	77fo	70	A	1 + 2	50dB	48dB	3.002	-1.002		2.501	.855			A	
16															
17															
18															
19															
20															



GATE 7 (Outer Left)



GATE 7 (Inner Right)

**KLEINFELDER**

An employee owned company

ULTRASONIC TEST REPORT

GATE 8

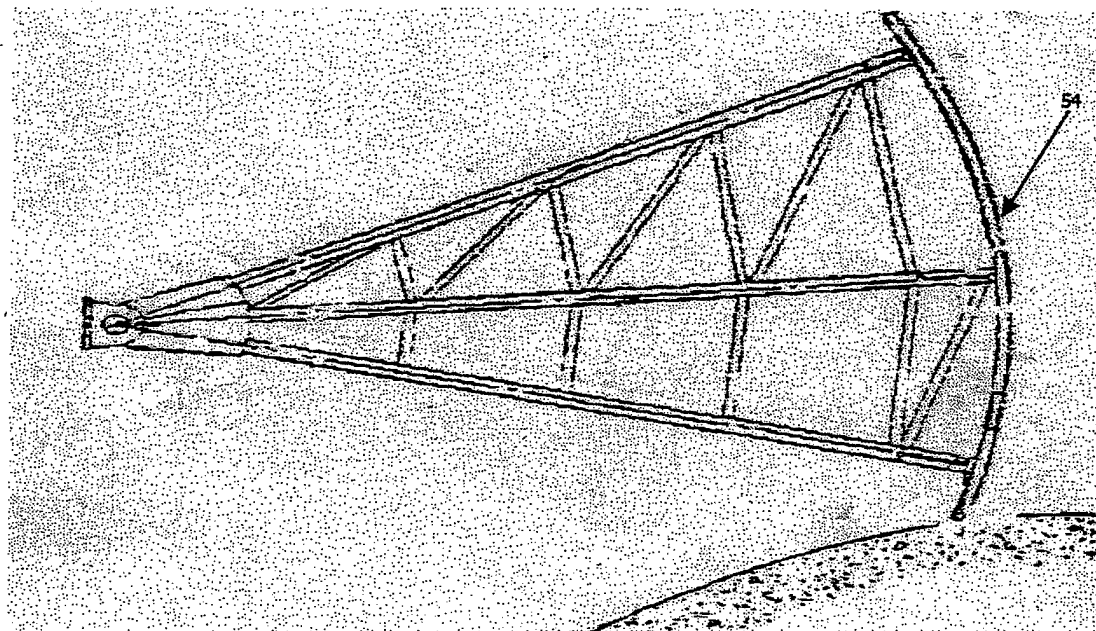
PROJECT NAME: Walla Walla; Lower Granite DamDATE: 10-2/10-13/00PROJECT NO.: 21-6149-01PAGE: 10 of 10**INFORMATION ON REJECTED WELDS**

LINE NUMBER	INDICATION NUMBER	TRANSDUCER ANGLE	FROM FACE	LEG	DECIBALS				DISCONTINUITY				Discontinuity Evaluation	Remarks	
					Indication Level	Reference Level	Attenuation Factor	Indication Rating	Length	Angular Distance (Sound Path)	Depth from "A" Surface	DISTANCE			
												From X			From Y
1	54	70	A	1 + 2	48dB	48dB	.016	-.016	2"	.922	.315			A	
2	55w	70	A	1 + 2	50dB	48dB	1.9	.1	1.125"	1.950	.667			A	
3	56fi	70	A	1 + 2	48dB	48dB	-.246	.246		.877	.300			A	
4	57w	70	A	1 + 2	48dB	48dB	3.196	-3.196	2.75"	2.598	.888			A	
5															
6															
7															
8															
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10															
11															
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13															
14															
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18															
19															
20															

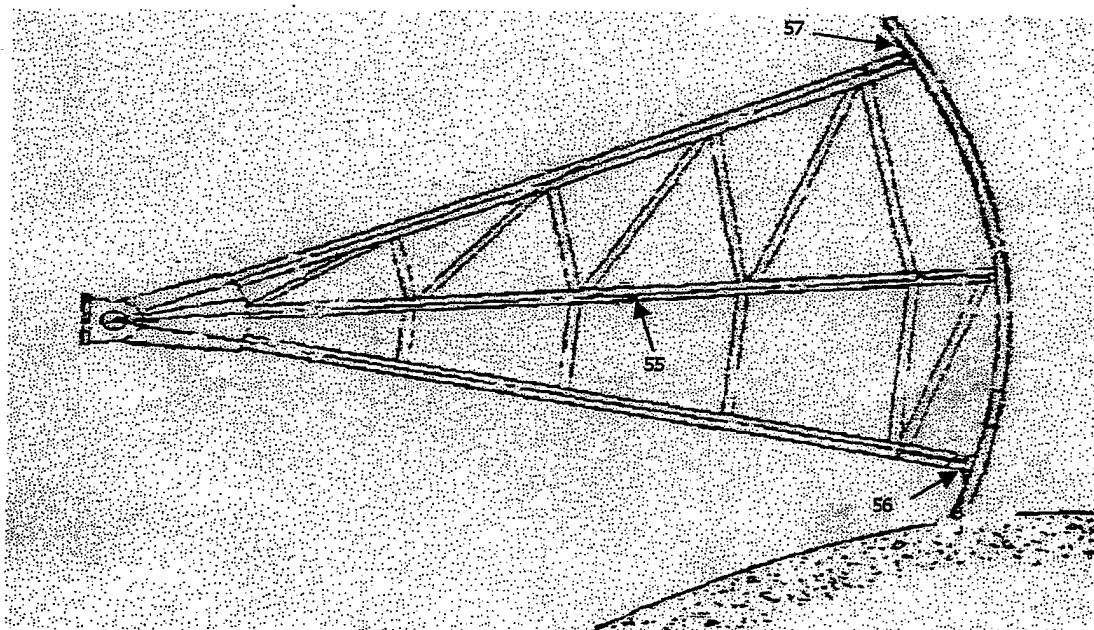
We the undersigned, certify the statements in this record are correct and the welds were prepared and tested in accordance with the requirements of
 ANSI/AASHTO/AWS D1.5 (1995) Bridge Welding Code.

year

INSPECTED BY: Destry K. Hall / Jim FisherASNT LEVEL: 2 / 2SIGNATURE: TEST DATE: 10-2/10-13/00



GATE 8 (Inner Right)



GATE 8 (Outer Left)



Lower
Granite
Dam

10/06/00

1-1

Gate 1

Top horizontal girder, right side,
between stiffeners at radial strut
connection. Delaminated paint and
light corrosion due to poor drainage.



Lower
Granite
Dam

10/06/00

1-2

Gate 1

Top horizontal girder, right side,
between stiffeners at radial strut
connection. Delaminated paint and
light corrosion due to poor drainage.

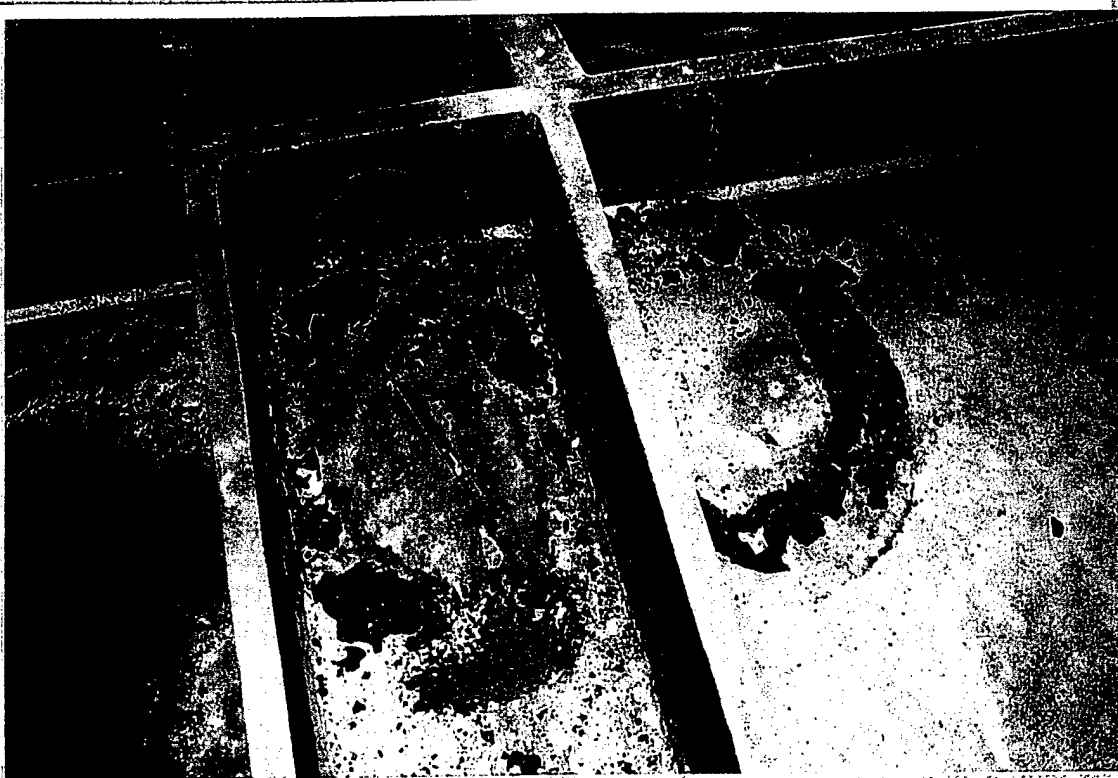


Lower
Granite
Dam

Gate 1
Side seal leak, left side.

10/06/00

1-3



Lower
Granite
Dam

Gate 1
Middle horizontal girder, right side,
between stiffeners at radial strut
connection. Delaminated paint and
light corrosion due to poor drainage.

10/06/00

1-4



Lower
Granite
Dam

10/06/00

1-5

Gate 1

Upstream end, bottom radial strut.
Ponding water between strut flanges
and horizontal girder flange due to
poor drainage.



Lower
Granite
Dam

10/06/00

1-6

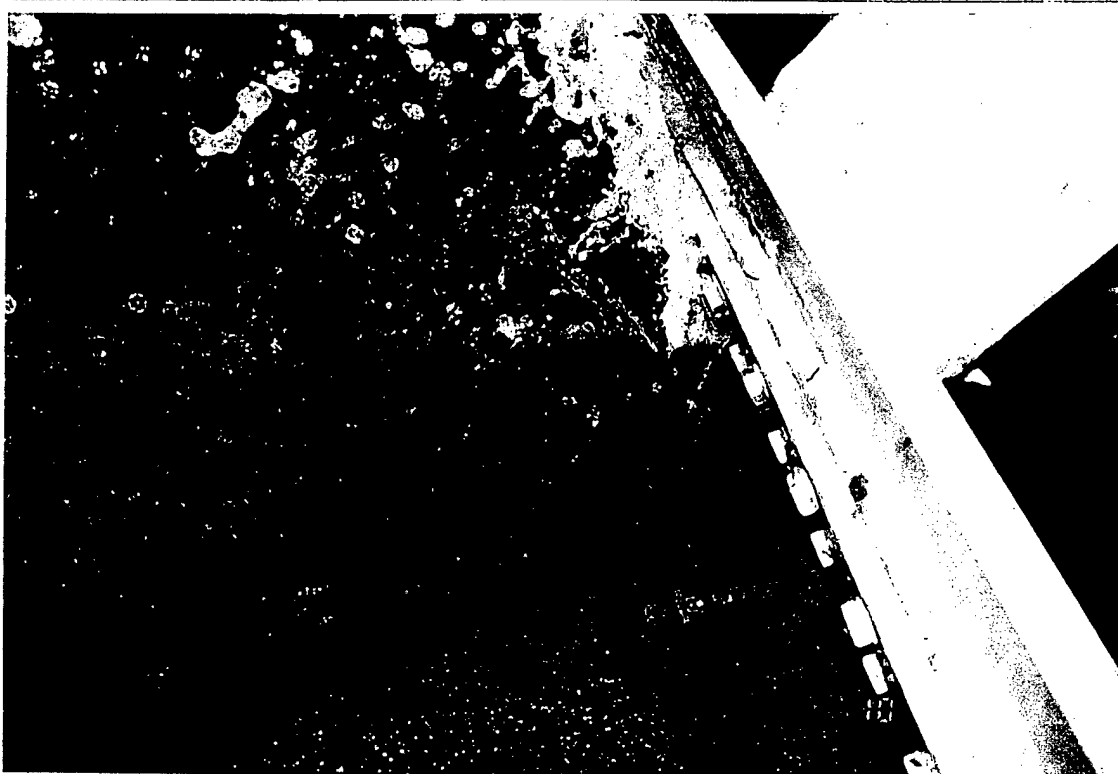
Gate 1

Left end of bottom horizontal girder.
Standing water, no drainage between
multiple stiffeners. Horizontal girder
to skin plate stiffeners, standing
water, debris and no drainage



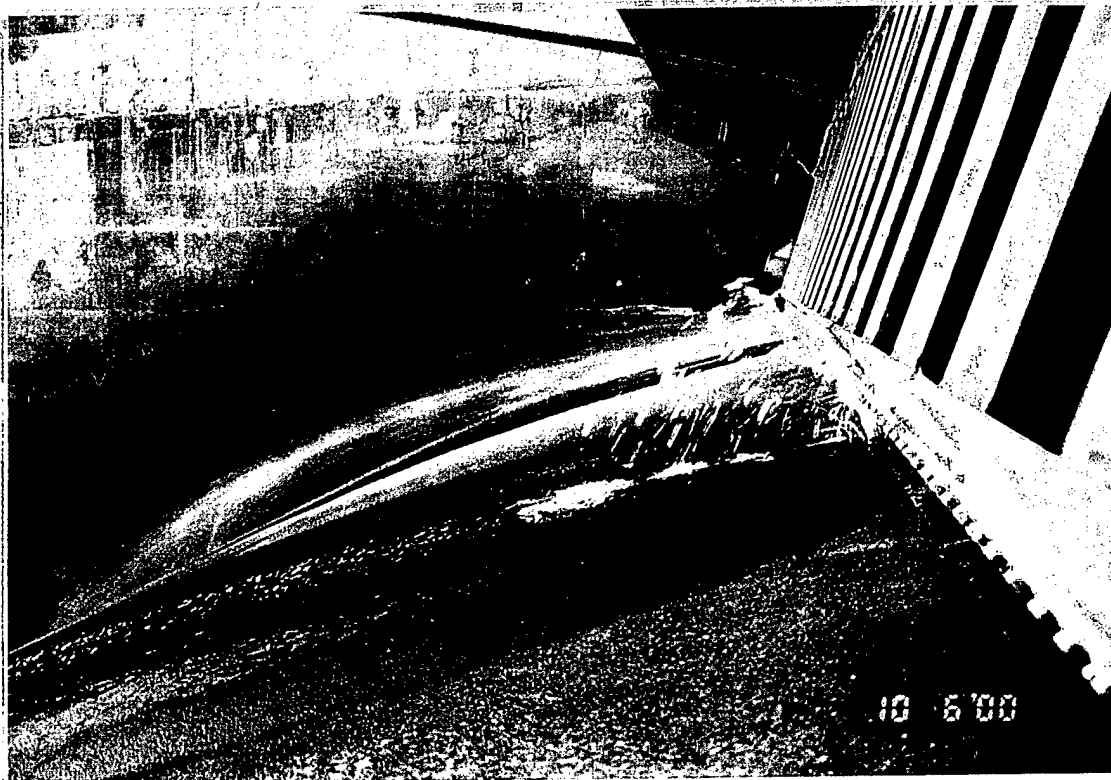
Lower
Granite
Dam
10/06/00
1-7

Gate 1
Bottom seal closure plate looking
upstream. Standing water between
closure plate, purlin webs and
skinplate. Typical.



Lower
Granite
Dam
10/06/00
1-8

Gate 1
Leak at center construction joint in
spillway monolith.

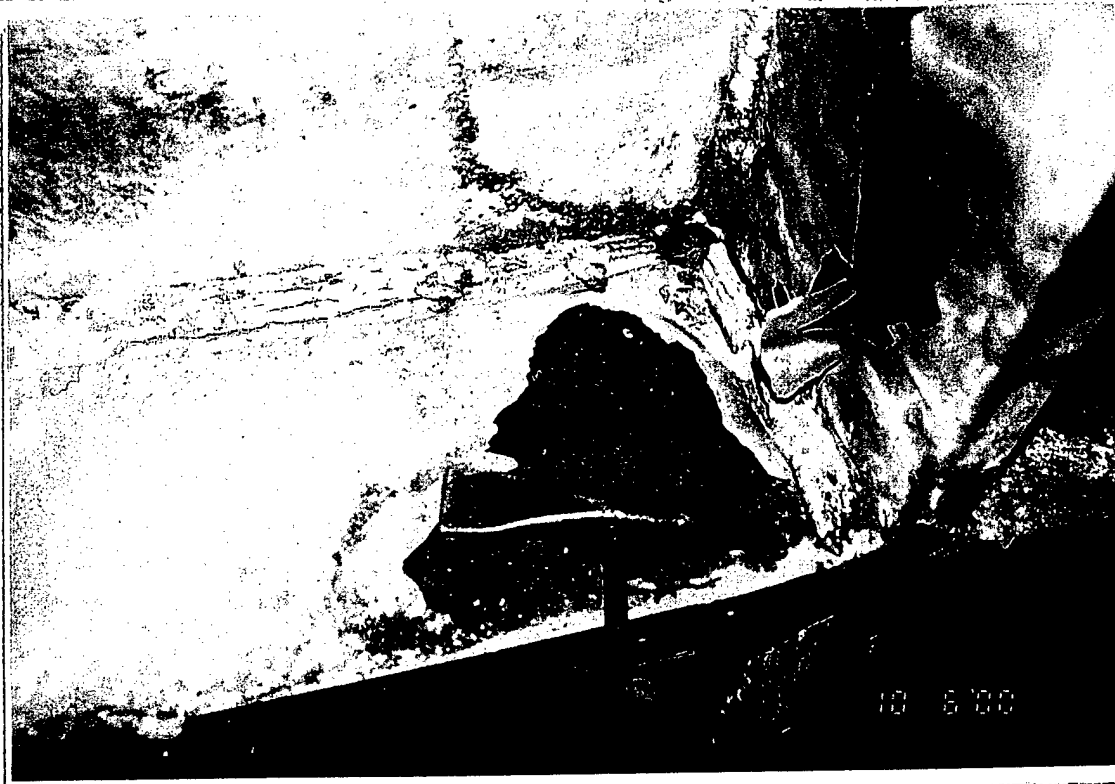


Lower
Granite
Dam

Gate 1
Leak at center construction joint in
spillway monolith.

10/06/00

1-9

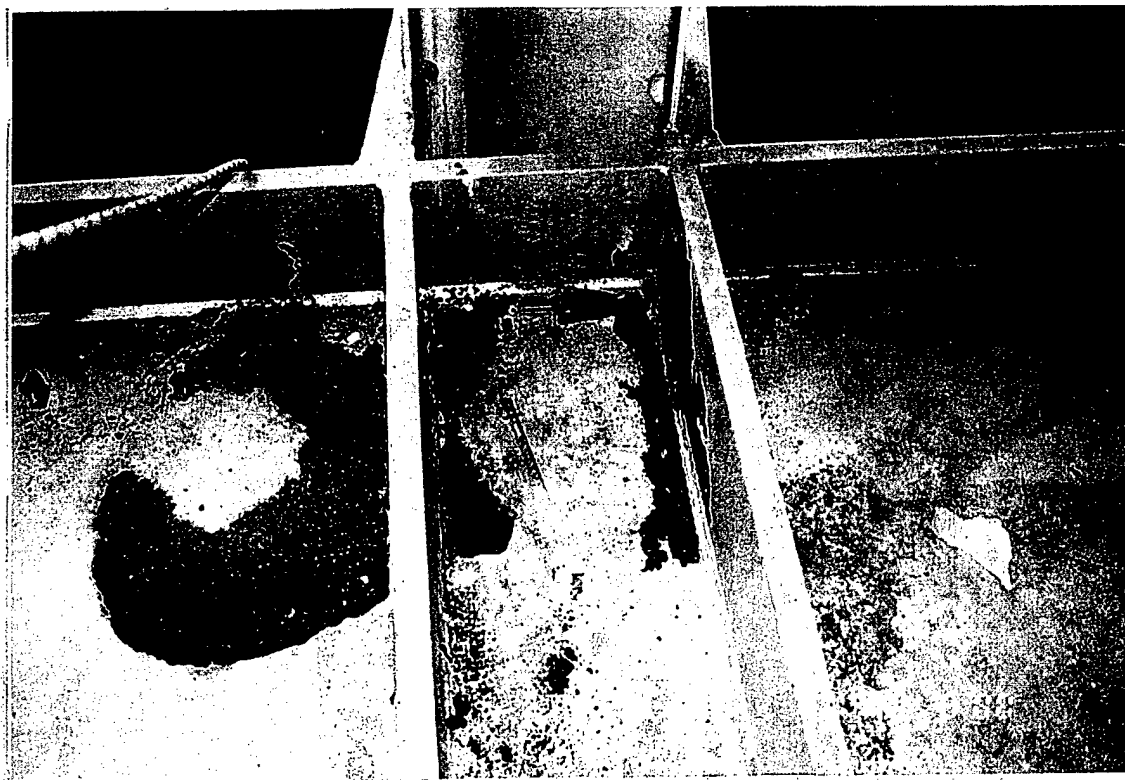


Lower
Granite
Dam

Gate 1
Bottom of bottom horizontal girder at
radial strut stiffeners. Delaminated
paint, light corrosion on girder flange
and stiffener plates. Typical.

10/06/00

1-10



Lower
Granite
Dam

10/06/00

1-11

Gate 1

Top horizontal girder, right side,
between stiffeners at radial strut
connection. Delaminated paint and
light corrosion due to poor drainage.



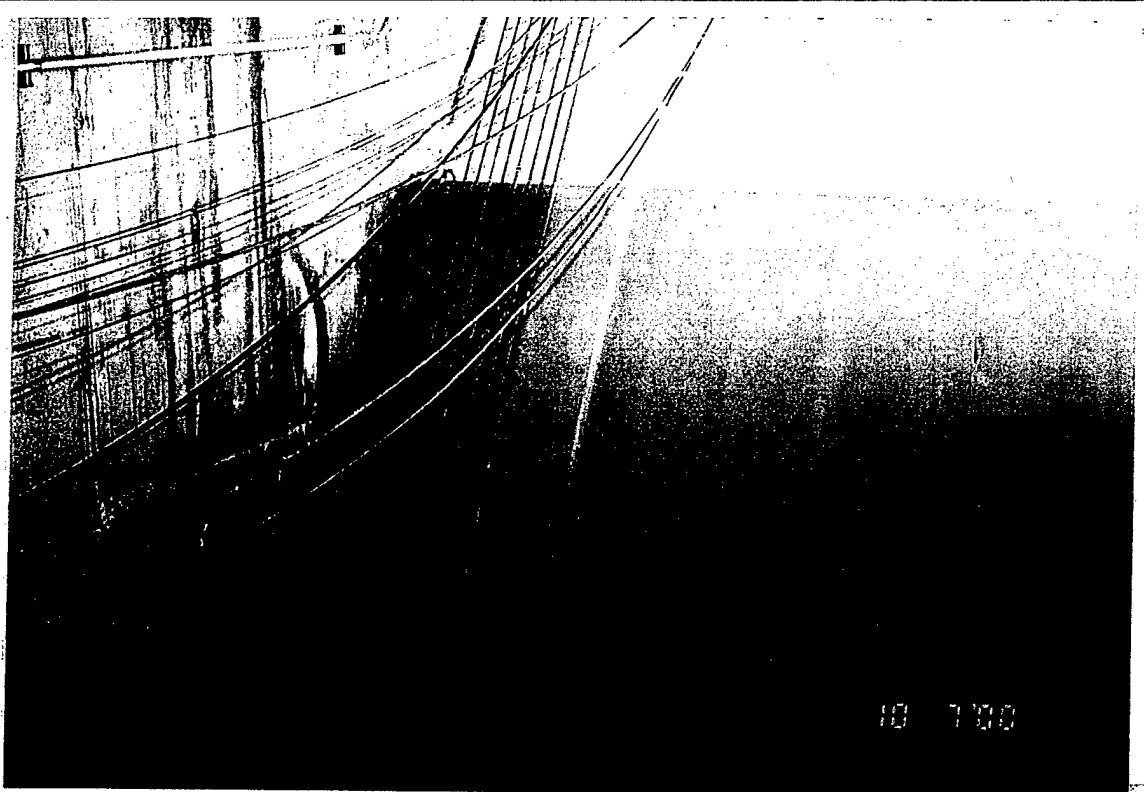
Lower
Granite
Dam

10/07/00

1-12

Gate 1

Exposed portion of upstream gate
face. Note: Surface collector
installed at this time.



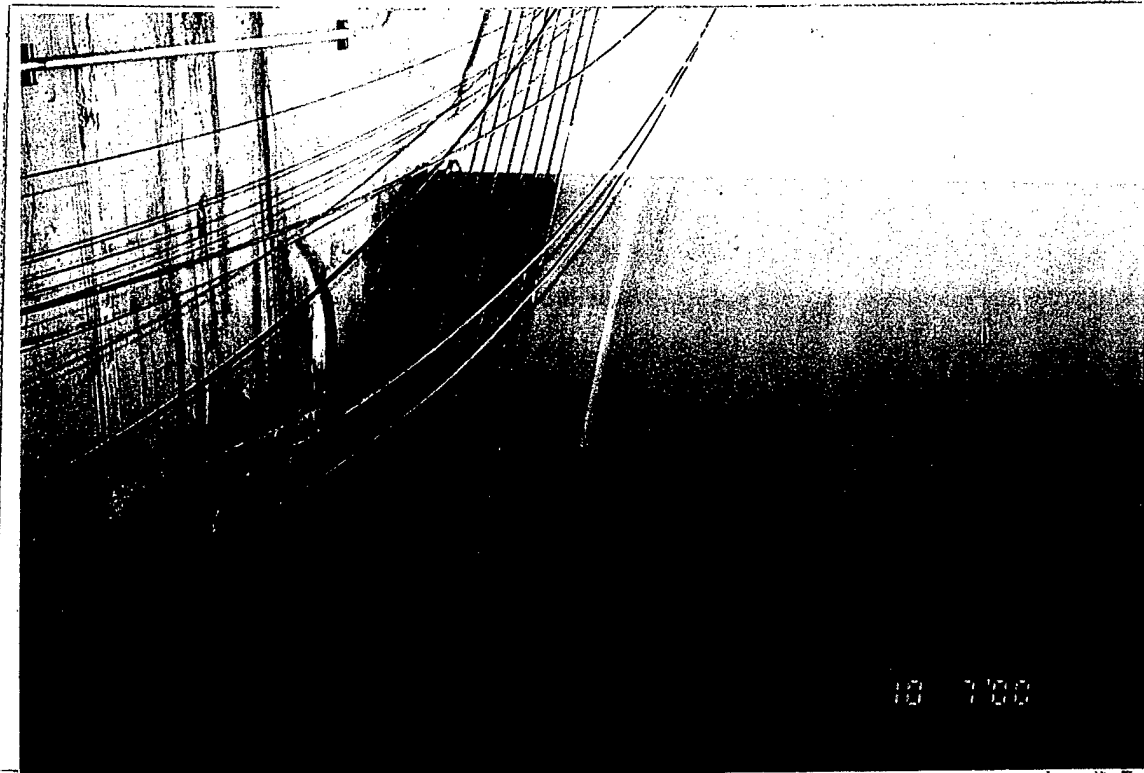
Lower
Granite
Dam

10/07/00

1-13

Gate 1

Exposed portion of upstream gate
face. Note: Surface collector
installed at this time.



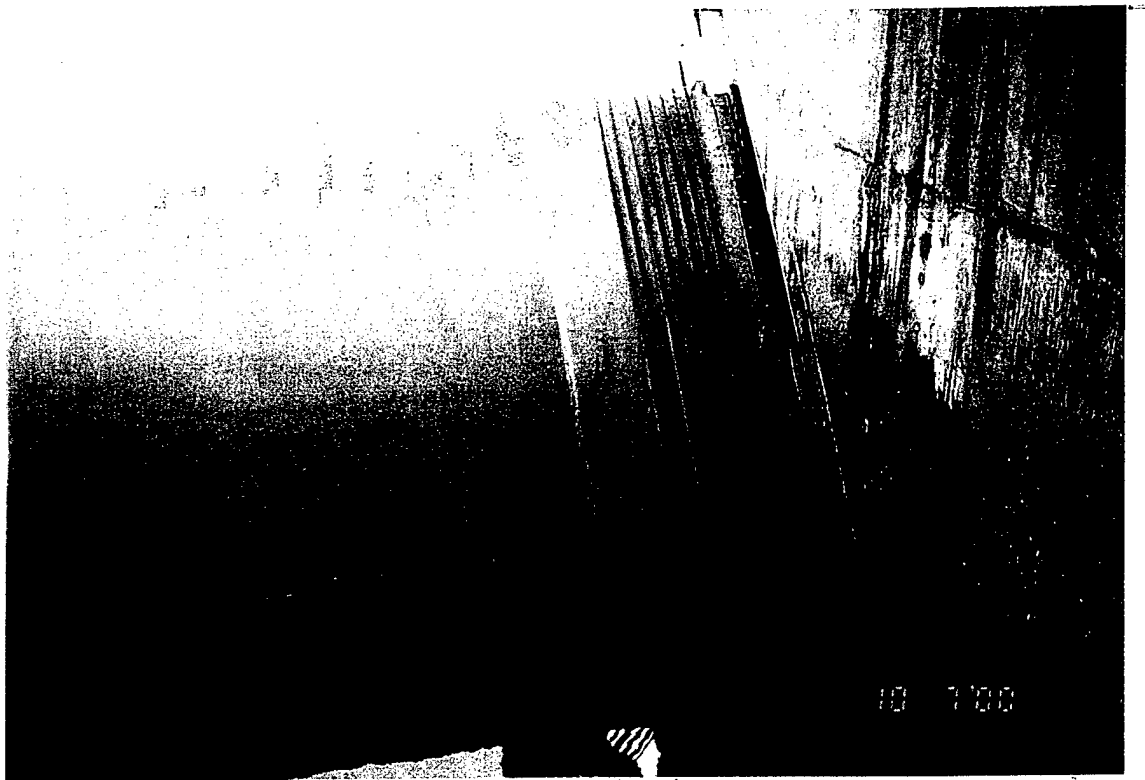
Lower
Granite
Dam

10/07/00

1-14

Gate 1

Exposed portion of upstream gate
face. Note: Surface collector
installed at this time.



Lower
Granite
Dam

10/07/00

1-15

Gate 1

Exposed portion of upstream gate face. Note: Surface collector installed at this time.



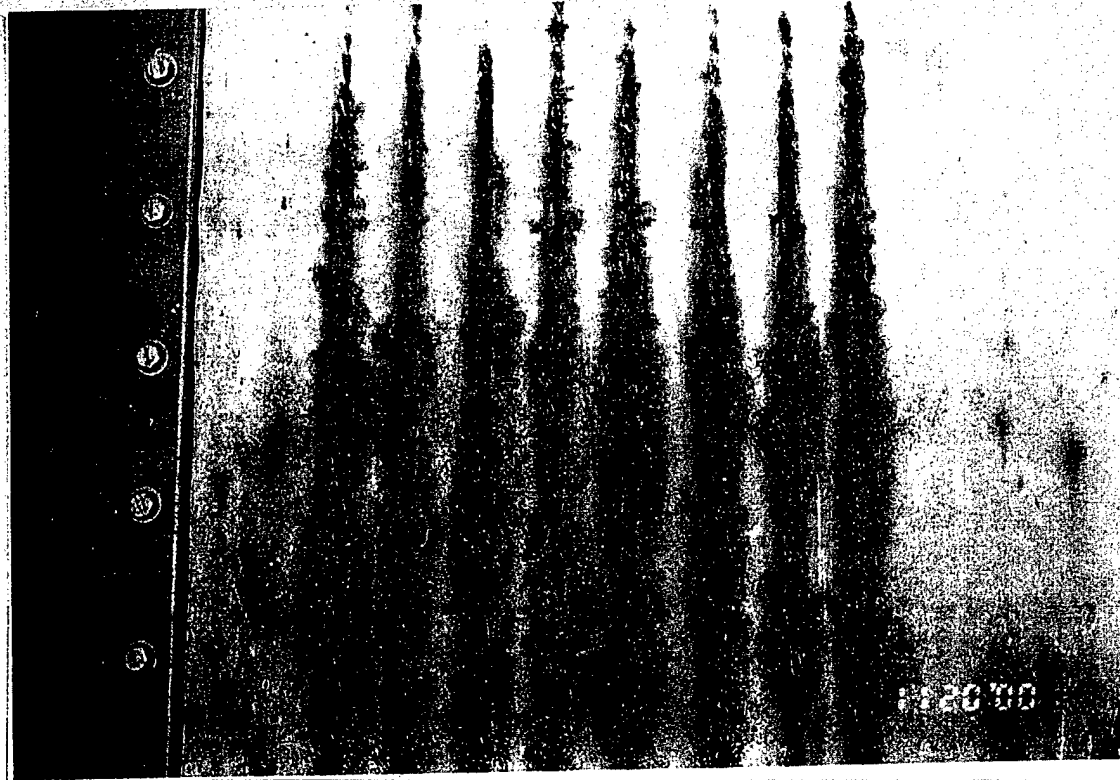
Lower
Granite
Dam

11/20/00

1-16

Gate 1

Typical skin plate condition. Light pitting near normal water surface. Note: Surface collector removed.



Lower
Granite
Dam

11/20/00

1-17

Gate 1

Typical wear plate condition. Light grooves due to cable wear, light to moderate corrosion.

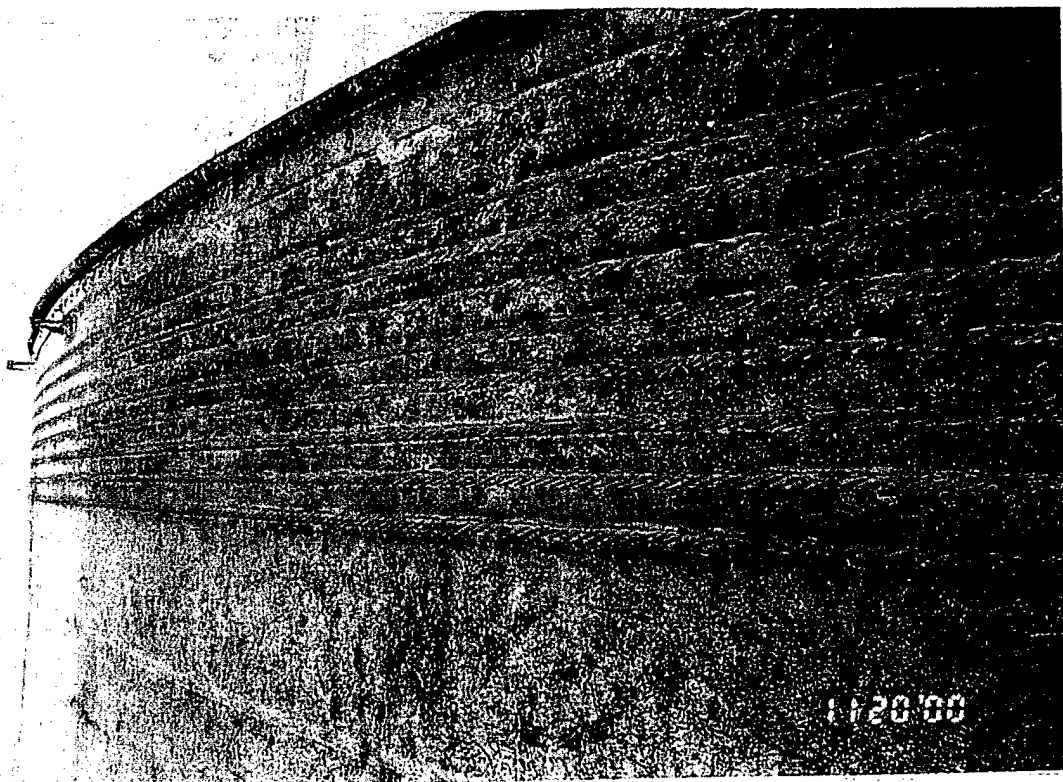


Lower
Granite
Dam

11/20/00

Gate 1

Typical skin plate condition. Light pitting near normal water surface.
Note: Surface collector removed.



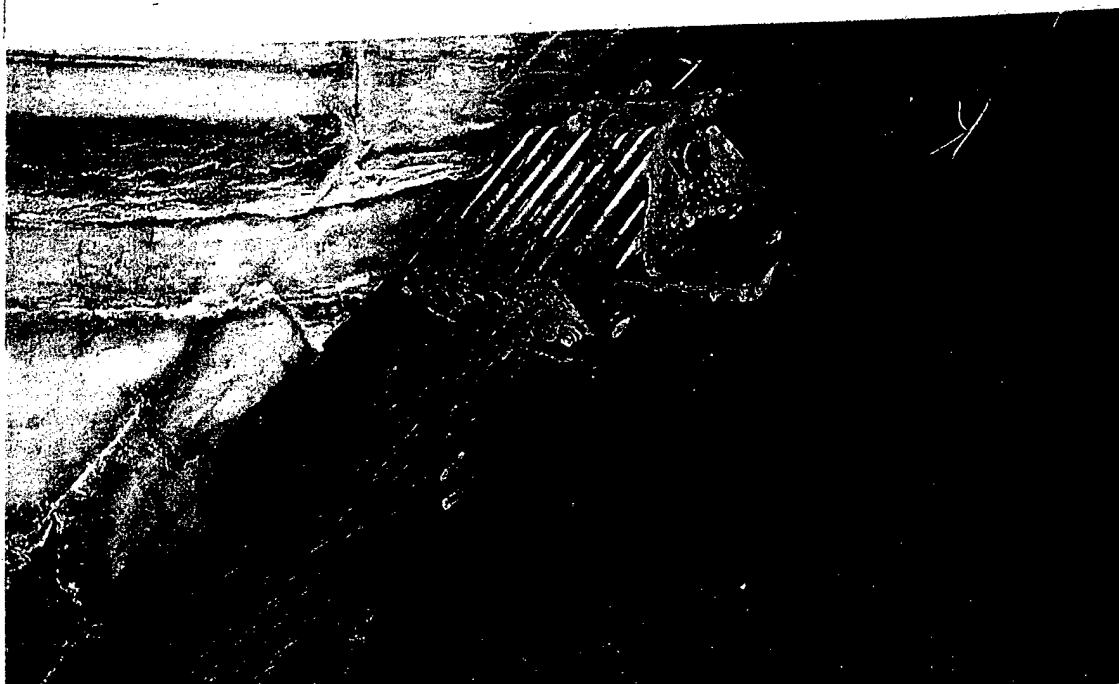
Lower
Granite
Dam

11/20/00

1-19

Gate 1

Typical wear plate condition. Light grooves due to cable wear, light to moderate corrosion.



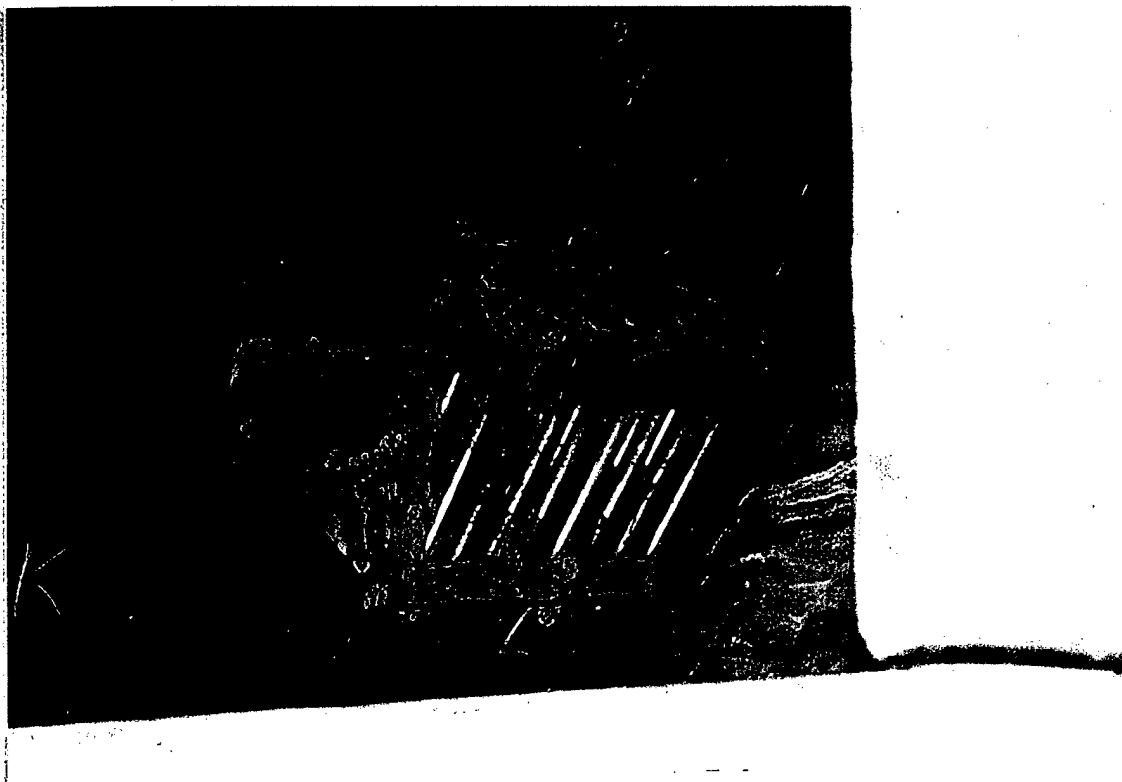
Lower
Granite
Dam

11/20/00

1-20

Gate 1

Right side hoist connection. Light corrosion on lifting lugs and plates.



Lower
Granite
Dam

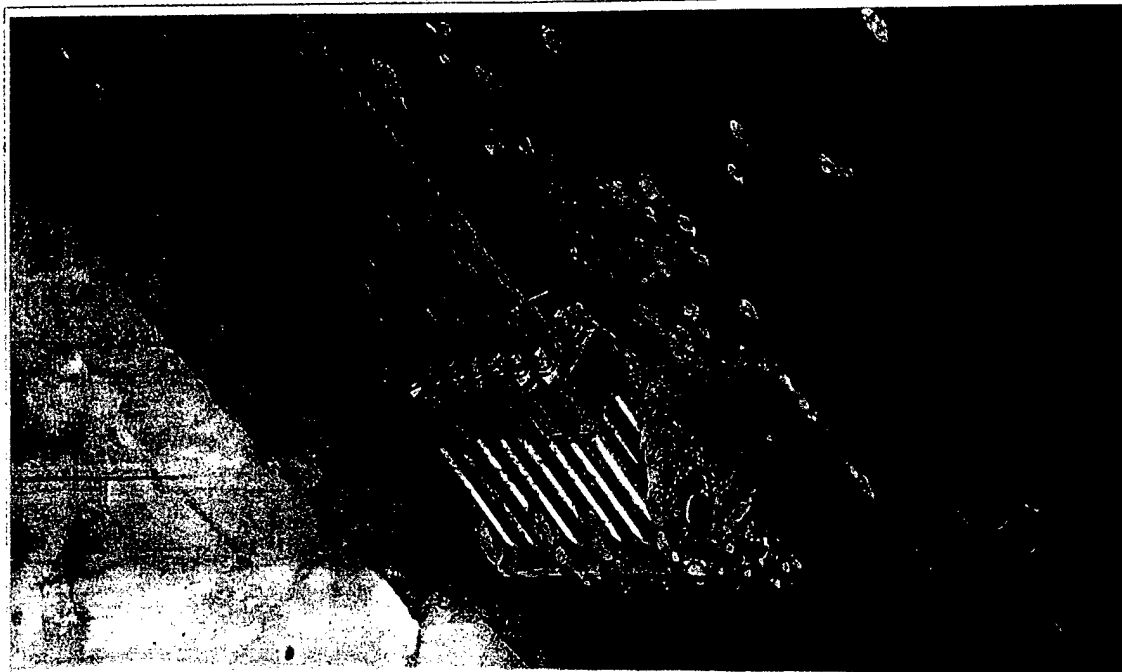
Gate 1

Right side hoist connection. Light
corrosion on lifting lugs and plates.

Note: excellent condition of stainless
steel U-bolts.

11/20/00

1-21



Lower
Granite
Dam

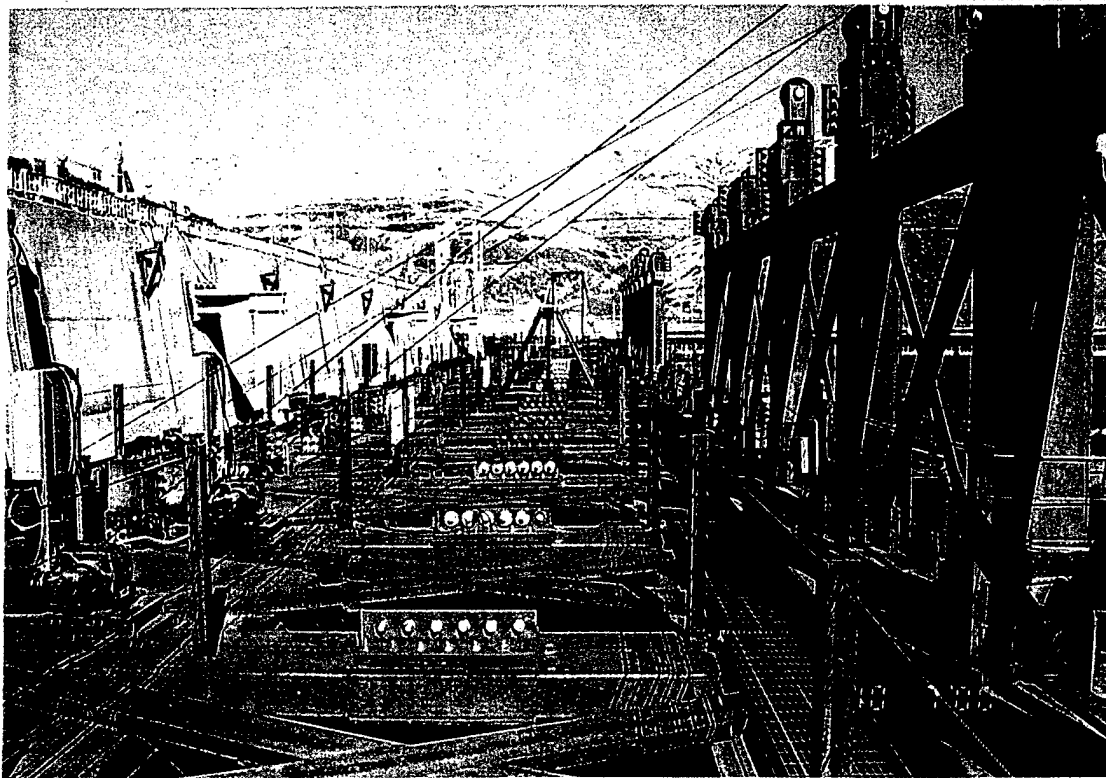
Gate 1

Left side hoist connection. Light
corrosion on lifting lugs and plates.

Note: excellent condition of stainless
steel U-bolts.

11/20/00

1-22

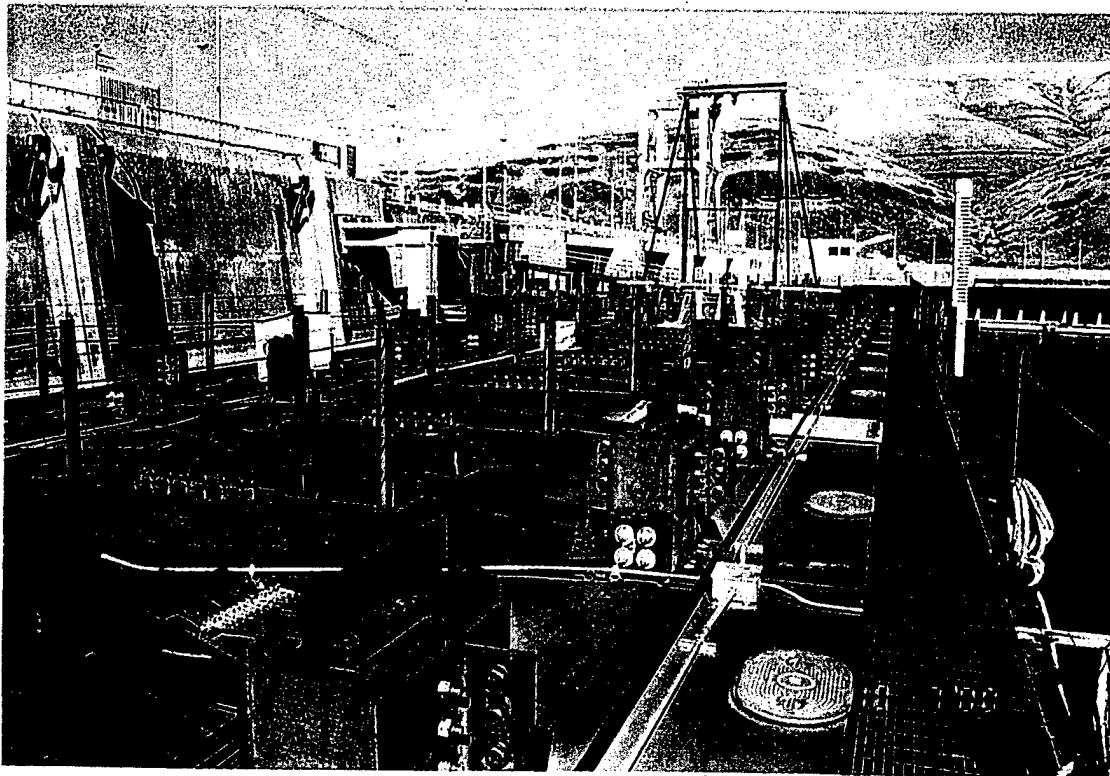


Lower
Granite
Dam

Gate 1
Surface collector installed at Gate 1.

10/07/00

1-23



Lower
Granite
Dam

Gate 1
Surface collector installed at Gate 1.

10/07/00

1-24



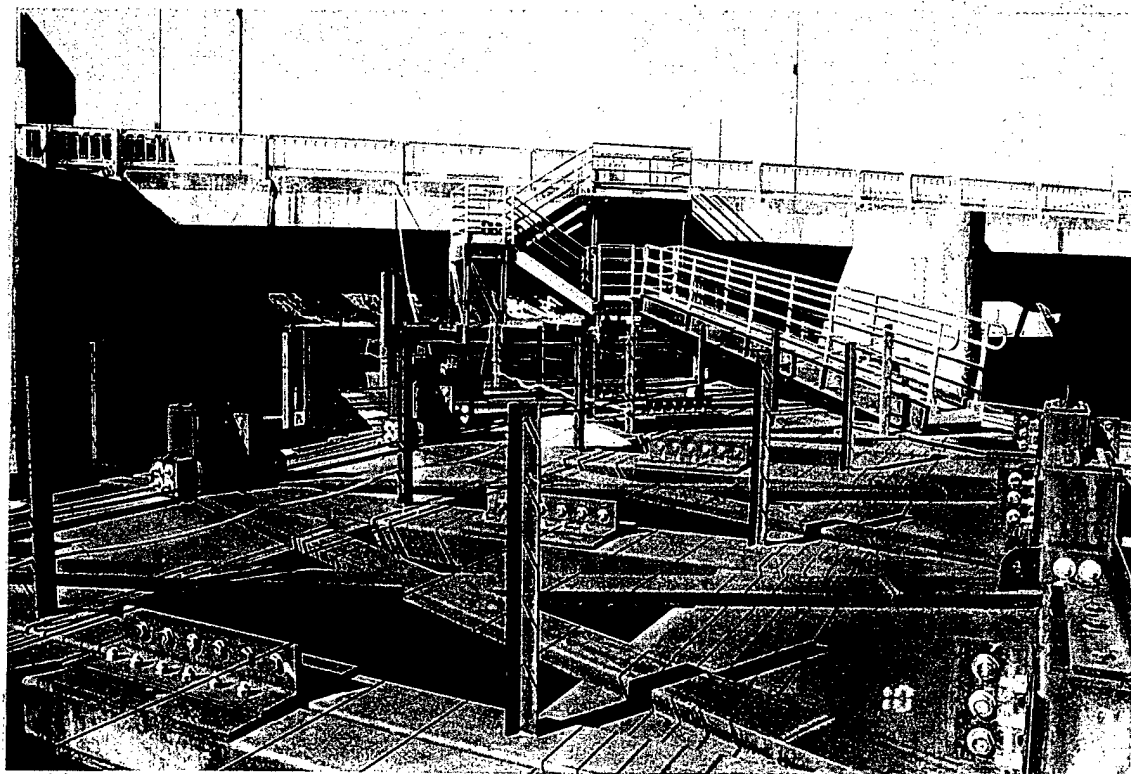
Lower
Granite
Dam

Gate 1

Gate 1 top stop log with surface
collector attached to upstream side.

10/07/00

1-25



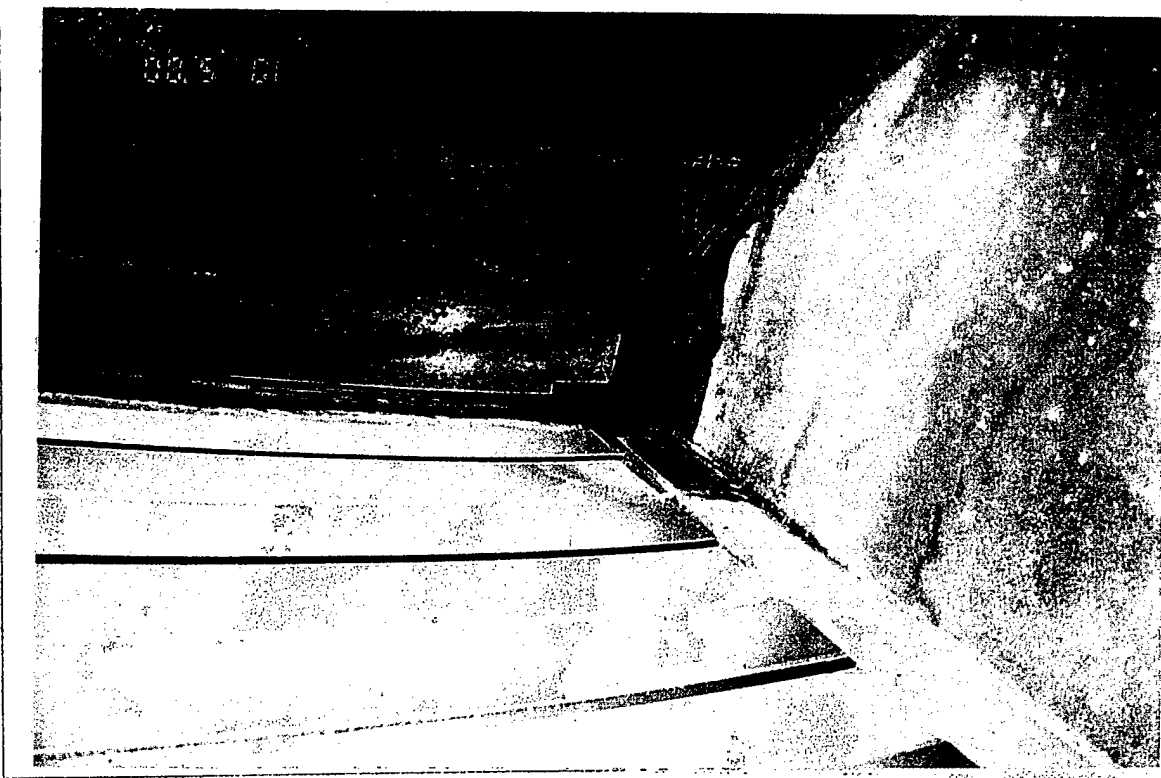
Lower
Granite
Dam

Gate 1

Surface collector installed at Gate 1.

10/07/00

1-26



Lower
Granite
Dam

10/05/00

2-1

Gate 2

Left end, middle horizontal girder.
Peeling paint on purlins, light
corrosion.



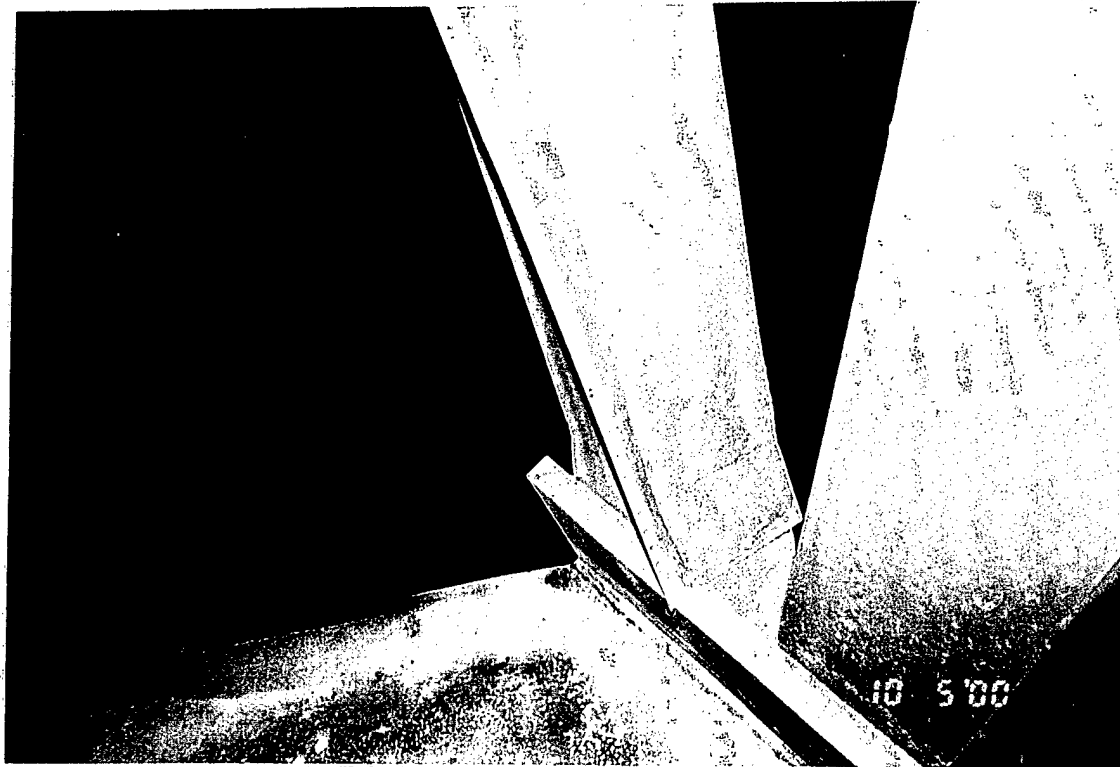
Lower
Granite
Dam

10/05/00

2-2

Gate 2

Left end, middle horizontal girder.
Peeling paint on purlins, light
corrosion.



Lower
Granite
Dam

10/05/00

2-3

Gate 2

Left frame, vertical Brace A at middle
horizontal girder. Approx. 3/4"
deformation in ST



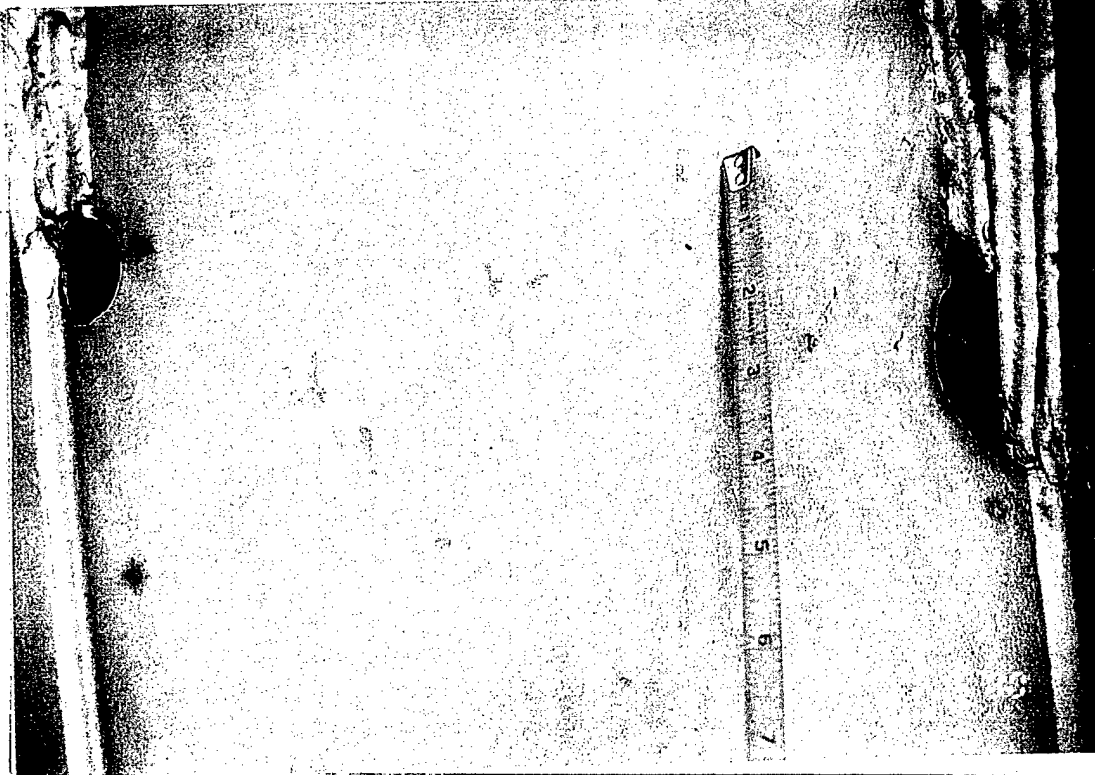
Lower
Granite
Dam

10/05/00

2-4

Gate 2

Left frame, vertical Brace A and K at
middle horizontal girder.
Misalignment in vertical braces due to
1" deformation in Brace A.

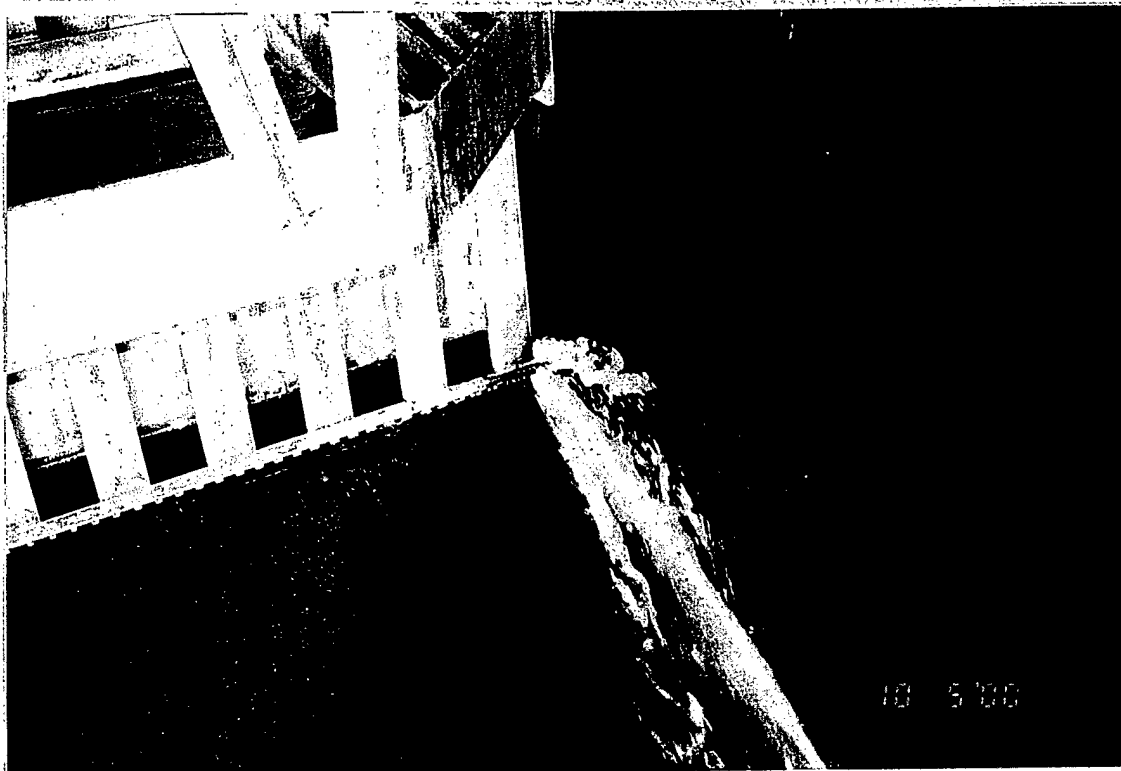


Lower
Granite
Dam

Gate 2
Left frame, Brace H. Coping in brace
at weld to top radial strut. Light
corrosion at isolated spots.

10/05/00

2-5

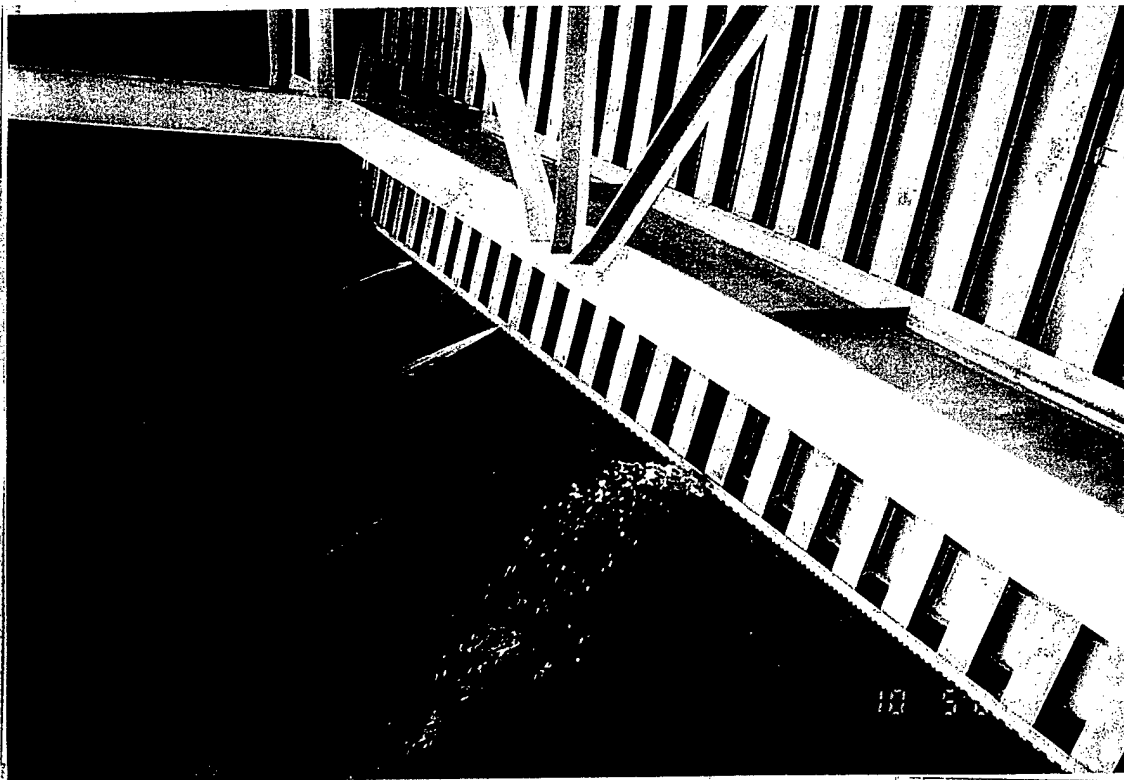


Lower
Granite
Dam

Gate 2
Bottom / side seal leak at bottom left
corner of gate.

10/05/00

2-6



Lower
Granite
Dam

10/05/00

2-7

Gate 2
Leak at center construction joint in
spillway monolith.



Lower
Granite
Dam

10/05/00

2-8

Gate 2
Left end of bottom horizontal girder.
Standing water, no drainage between
multiple stiffeners.



Lower
Granite
Dam

10/05/00

2-9

Gate 2

Left end of bottom horizontal girder.
Standing water, no drainage between
multiple stiffeners. Horizontal girder
to skin plate stiffeners, standing
water, debris and no drainage



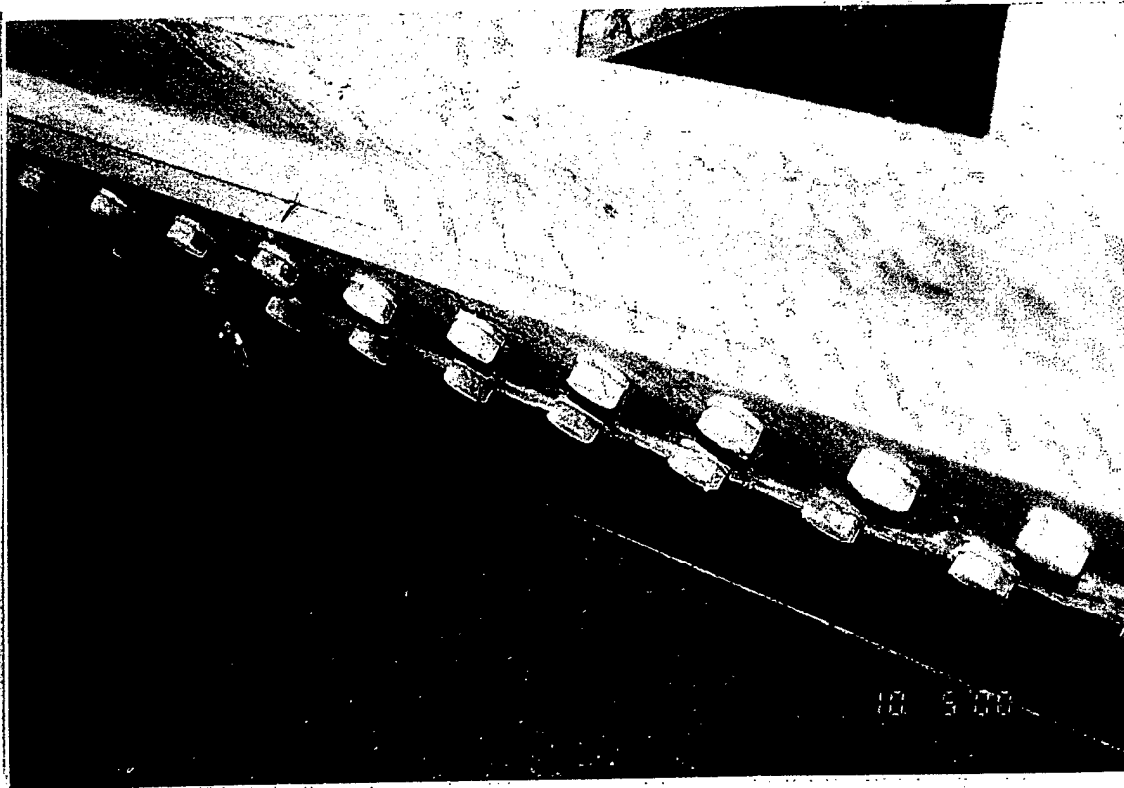
Lower
Granite
Dam

10/05/00

2-10

Gate 2

Bottom seal closure plate looking
upstream. Standing water between
closure plate, purlin webs and
skinplate. Typical. Leak at center
const. joint in spillway monolith.



Lower
Granite
Dam

10/05/00

2-11

Gate 2

Bottom seal keeper bar and closure
plate, typical.



Lower
Granite
Dam

10/05/00

2-12

Gate 2

Bottom seal closure plate looking
upstream. Standing water between
closure plate, purlin webs and
skinplate. Typical.



Lower
Granite
Dam

10/05/00

2-13

Gate 2

Close-up, right end of bottom
horizontal girder. Standing water, no
drainage between multiple stiffeners.



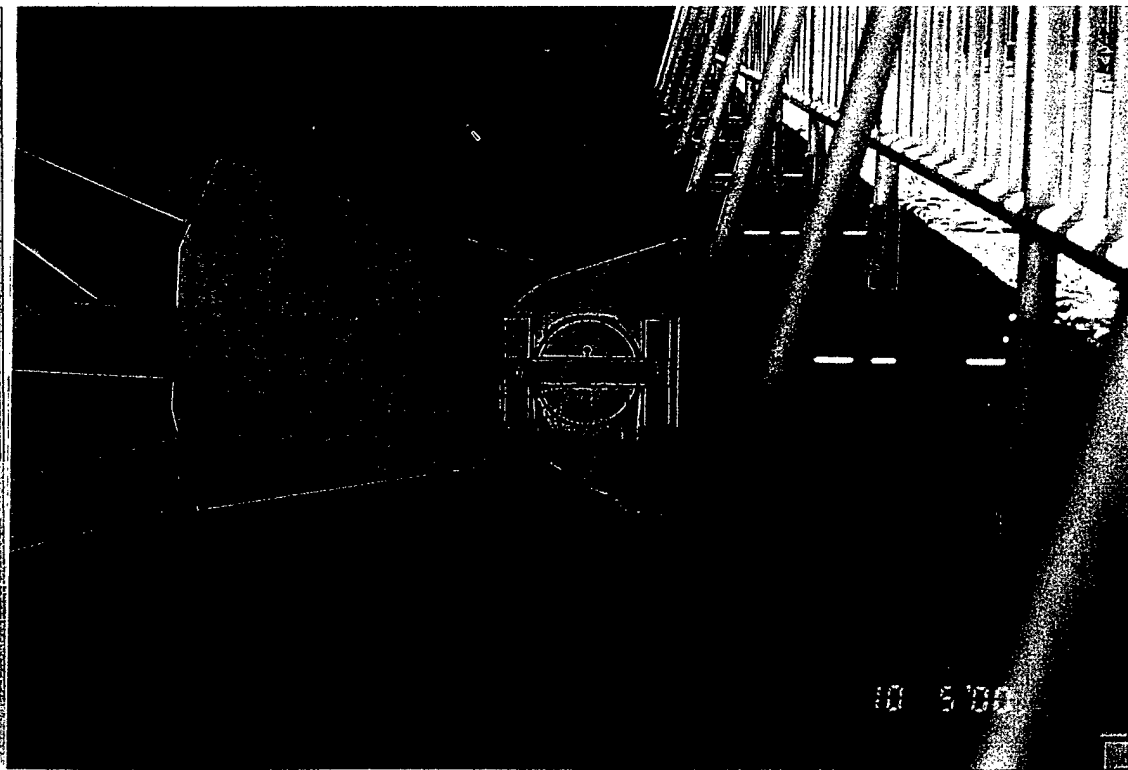
Lower
Granite
Dam

10/05/00

2-14

Gate 2

Right end of bottom horiz. girder.
Standing water, no drainage between
multiple stiffeners. Horizontal girder
to skin plate stiffeners, standing
water, debris and no drainage

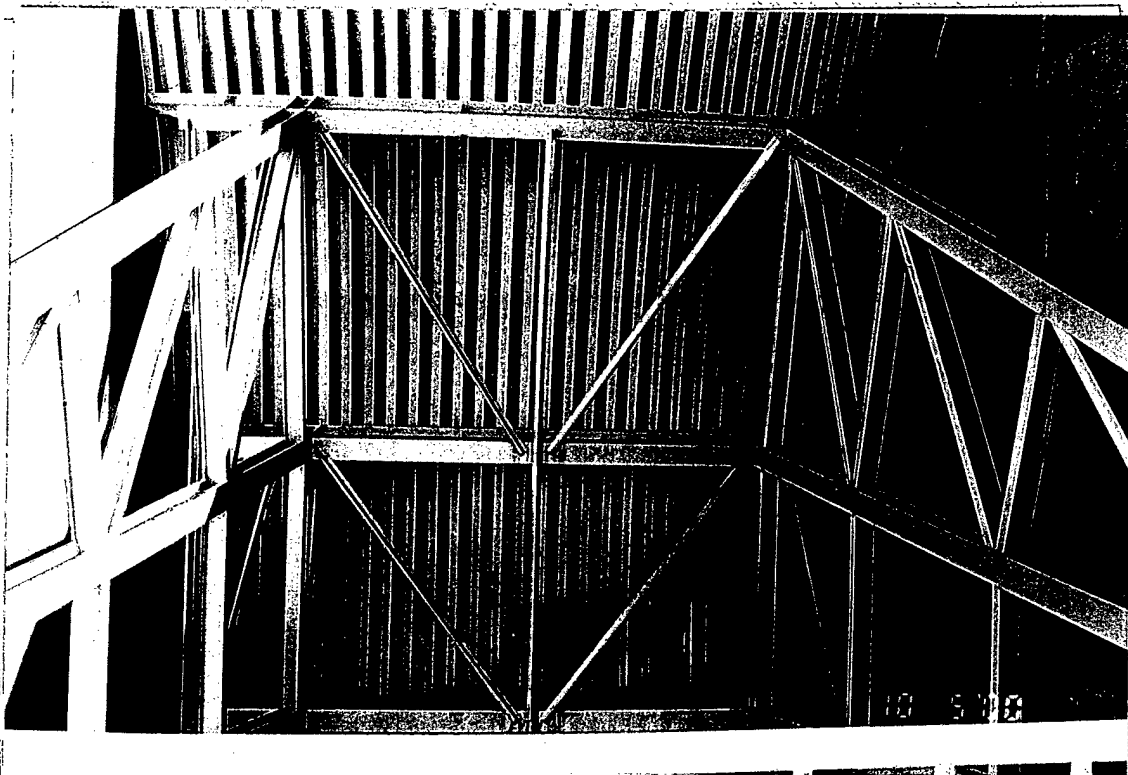


Lower
Granite
Dam

Gate 2
Left trunnion, typical.

10/05/00

2-15



Lower
Granite
Dam

Gate 2
Gate face and side frames, typical

10/05/00

2-16

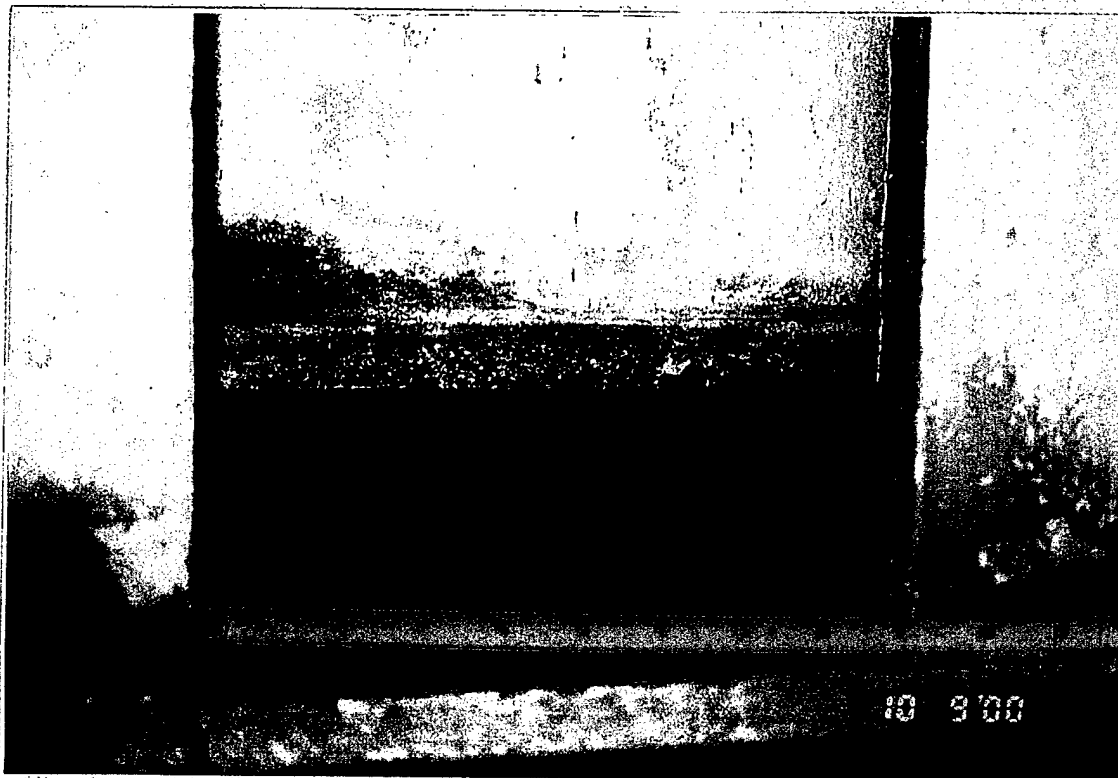


Lower
Granite
Dam

Gate 2
Top of right trunnion, typical.

10/05/00

2-17



Lower
Granite
Dam

Gate 2
Bottom seal closure plate looking
upstream. Standing water between
closure plate, purlin webs and
skinplate. Typical.

10/09/00

2-18



Lower
Granite
Dam

10/09/00

2-19

Gate 2

Bottom seal closure plate looking
upstream. Standing water between
closure plate, purlin webs and
skinplate. Typical.

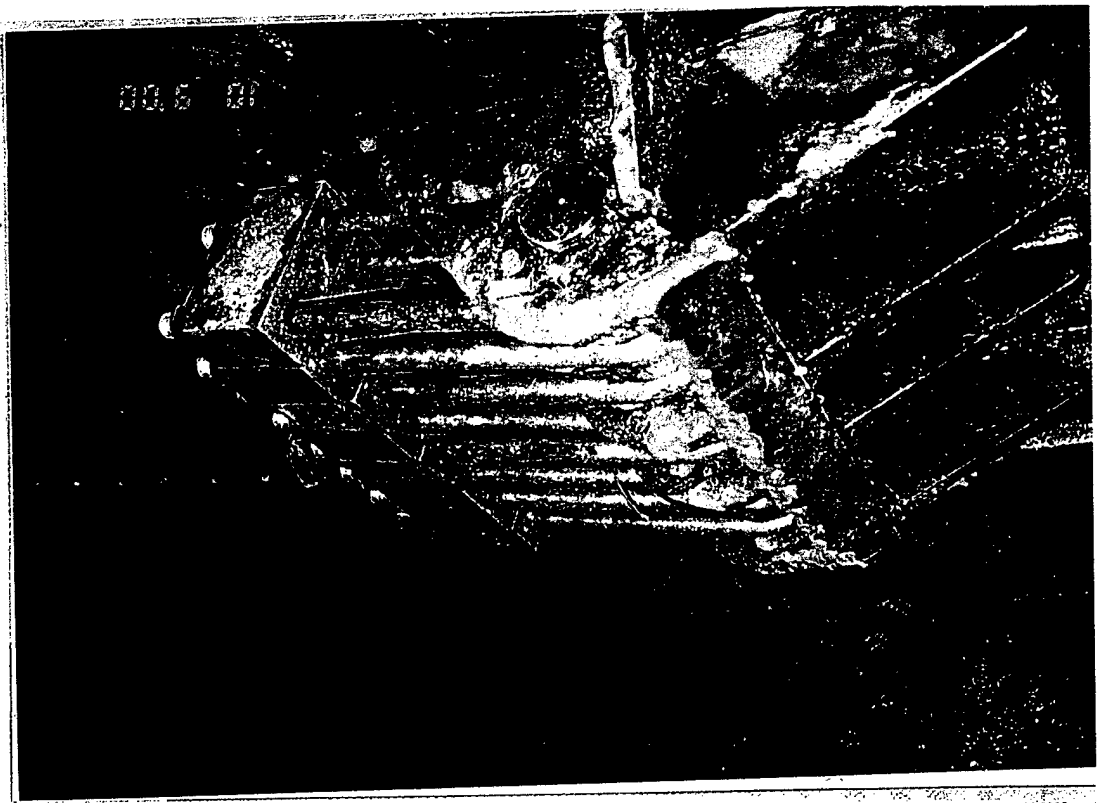


Lower
Granite
Dam

10/09/00

Gate 2

Bottom seal closure plate looking
upstream. Standing water between
closure plate, purlin webs and
skinplate. Typical.



Lower
Granite
Dam

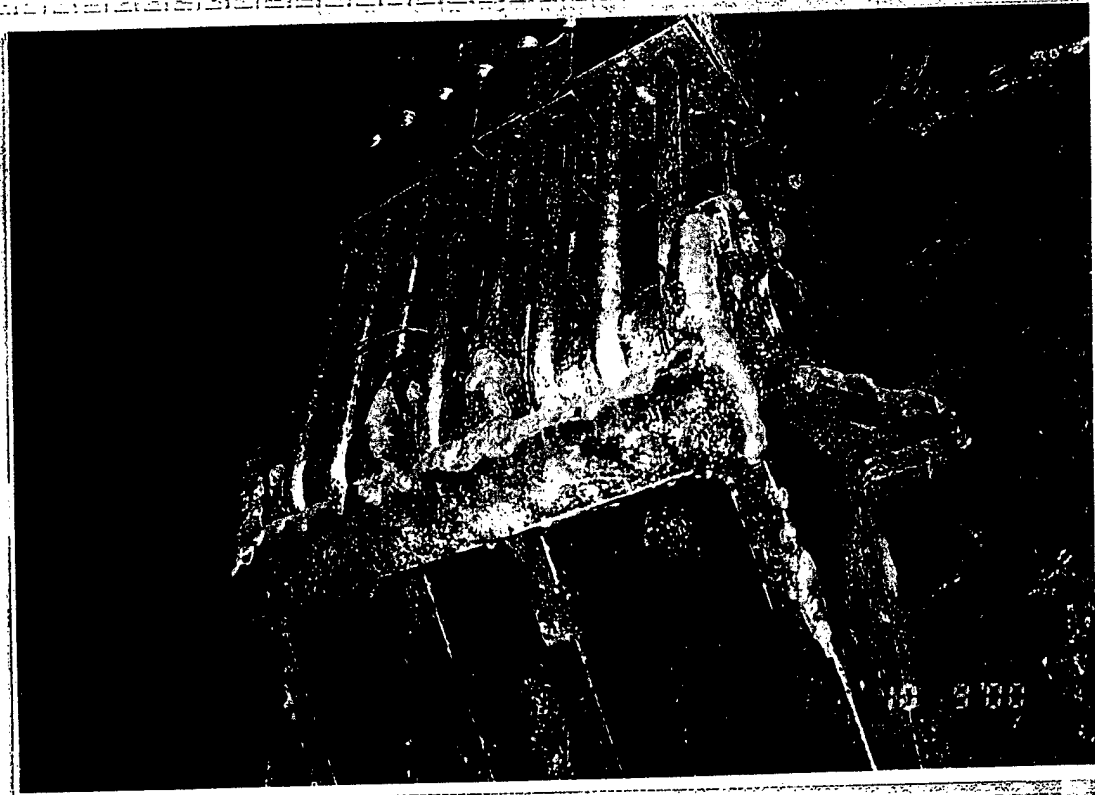
10/09/00

2-21

Gate 2

Left side hoist connection. Light corrosion on lifting lugs and plates.

Note: Excellent condition of stainless steel U-bolts.



Lower
Granite
Dam

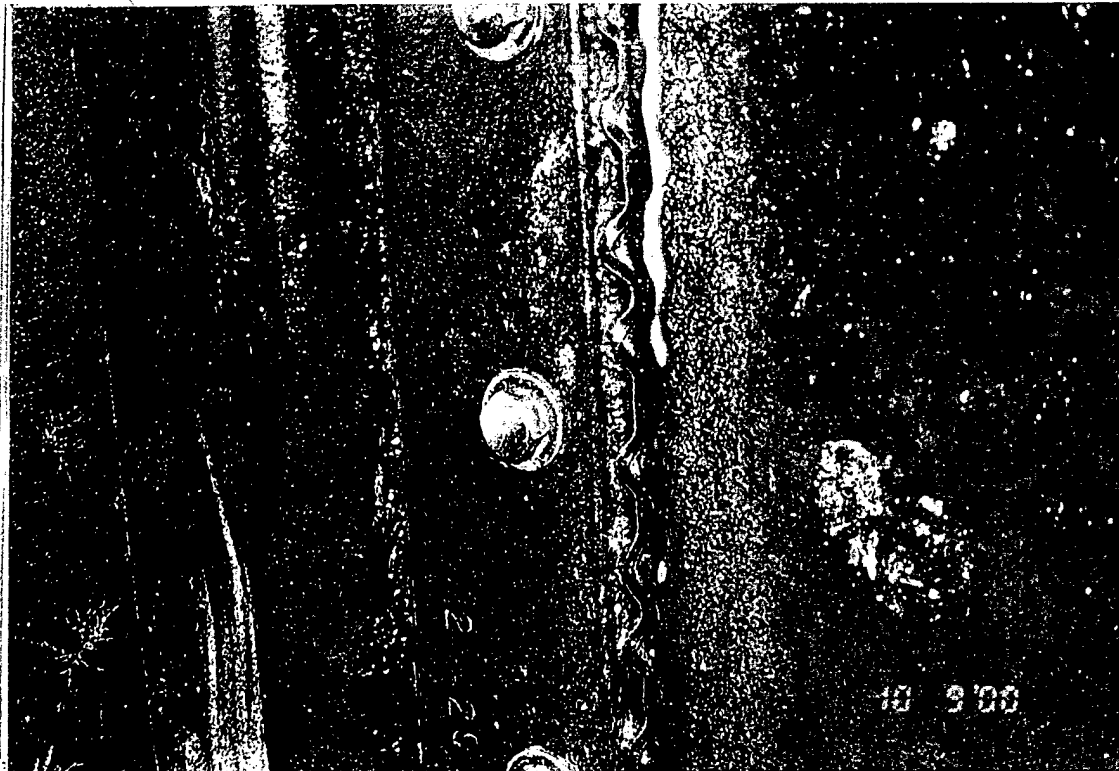
10/09/00

2-22

Gate 2

Left side hoist connection. Light corrosion on lifting lugs and plates.

Note: Excellent condition of stainless steel U-bolts.

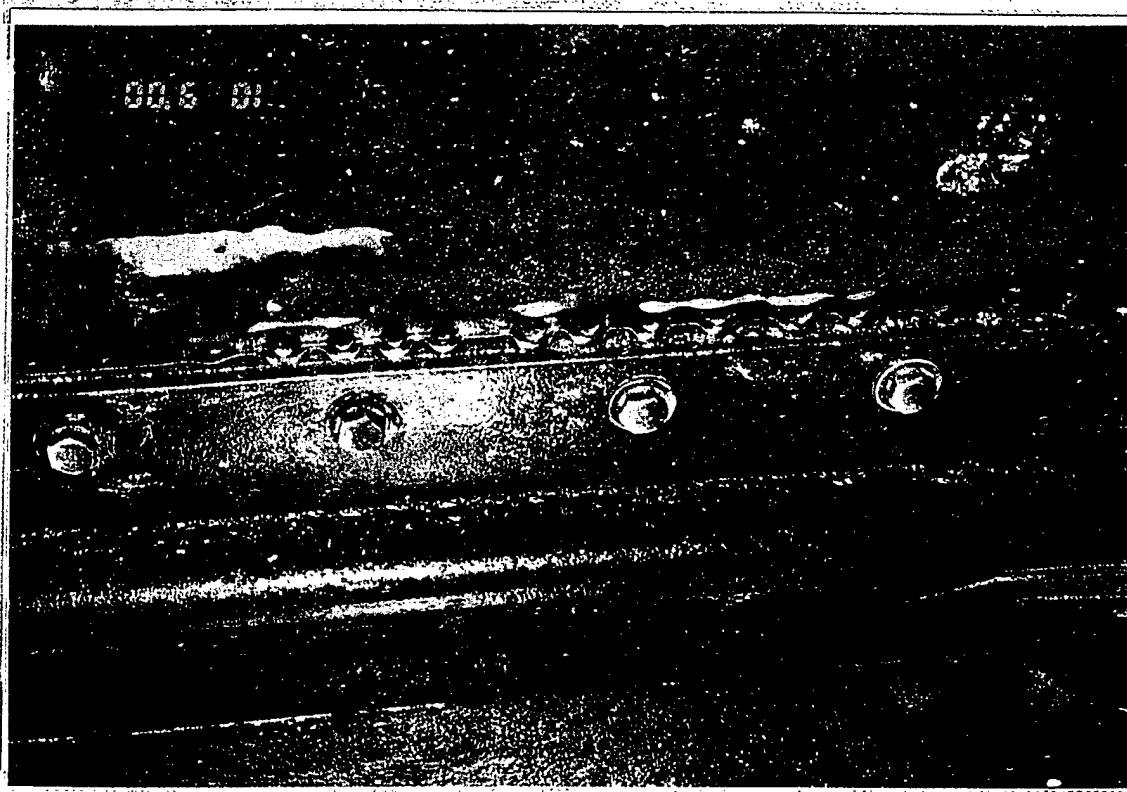


Lower
Granite
Dam

10/09/00

2-23

Gate 2
Upstream side of left side seal. Light corrosion and pitting on skin plate.



Lower
Granite
Dam

10/05/00

2-24

Gate 2
Upstream side of left side seal. Light corrosion and pitting on skin plate.

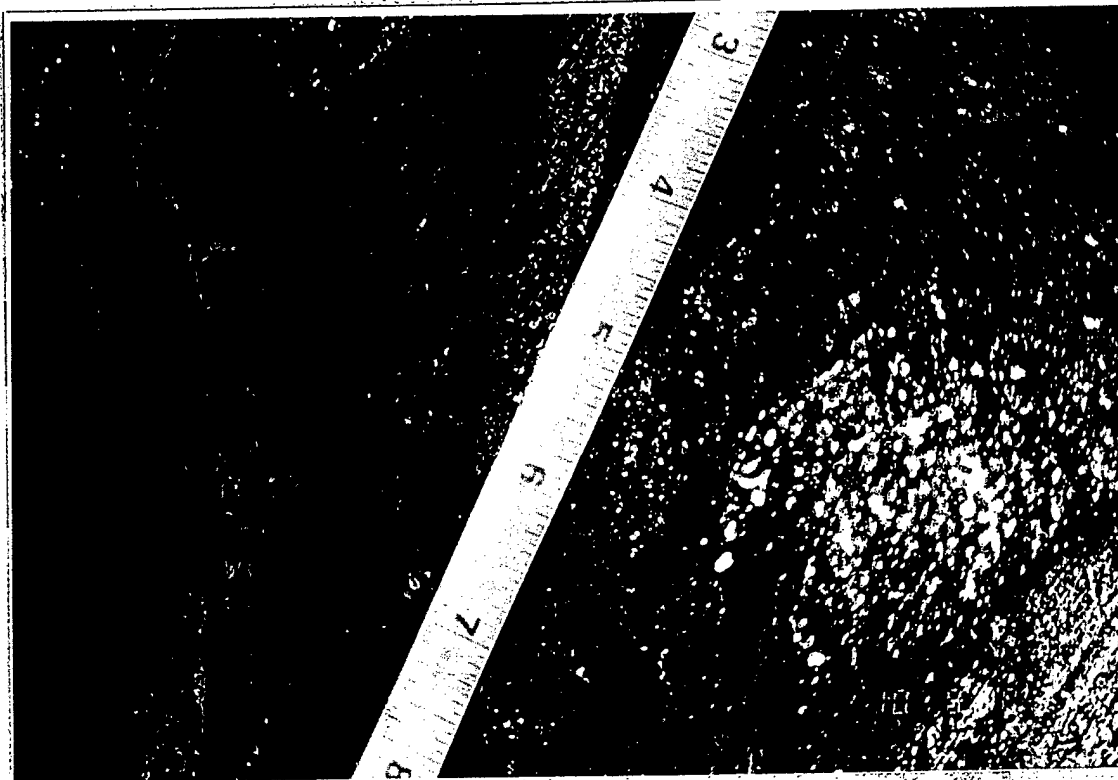


Lower
Granite
Dam

Gate 2
Close-up, skin plate, typical.

10/05/00

2-25

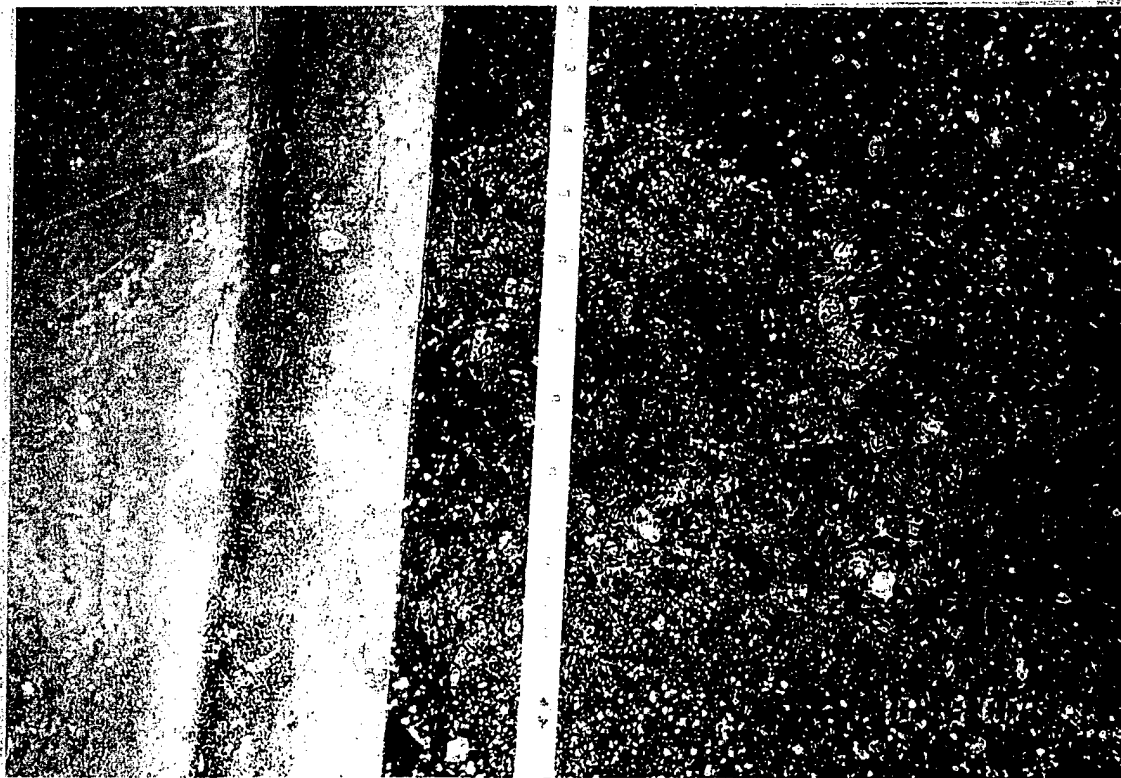


Lower
Granite
Dam

Gate 2
Close-up skin plate, typical.

10/09/00

2-26

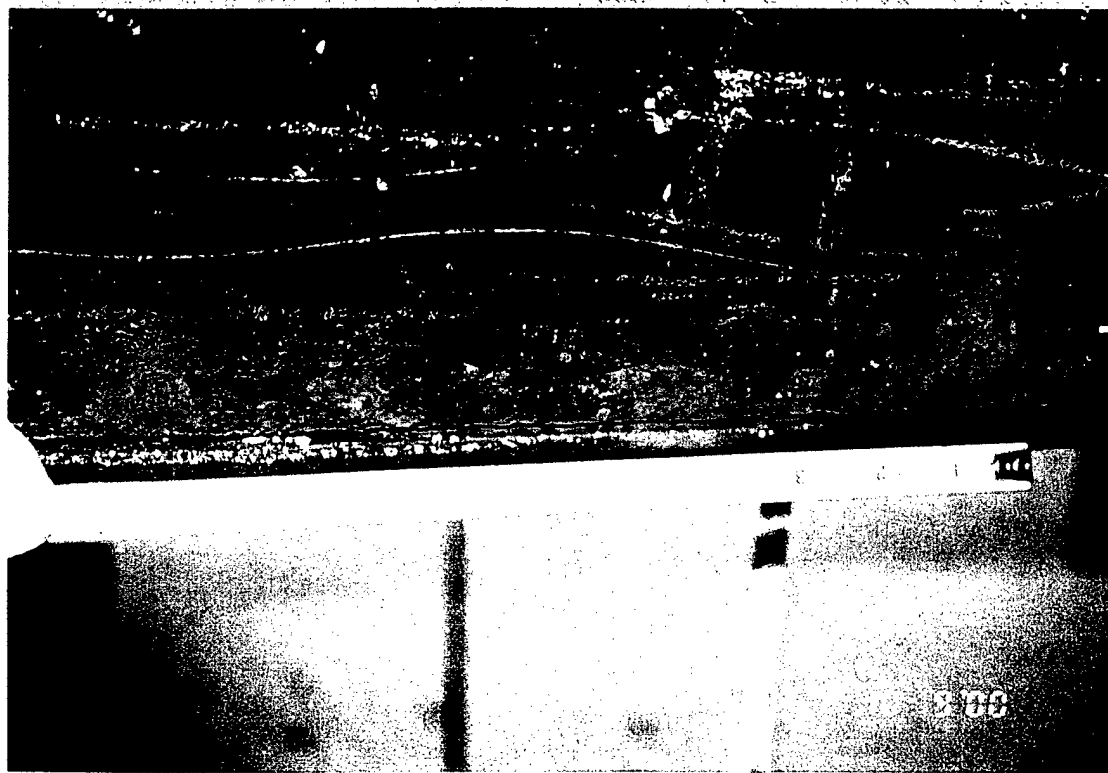


Lower
Granite
Dam

Gate 2
Embedded bottom seal plate, looking
down at spillway, typical.

10/09/00

2-27



Lower
Granite
Dam

Gate 2
Upstream side of bottom seal and
bottom of skin plate. Light to
moderate corrosion on skin plate.

10/09/00

2-28

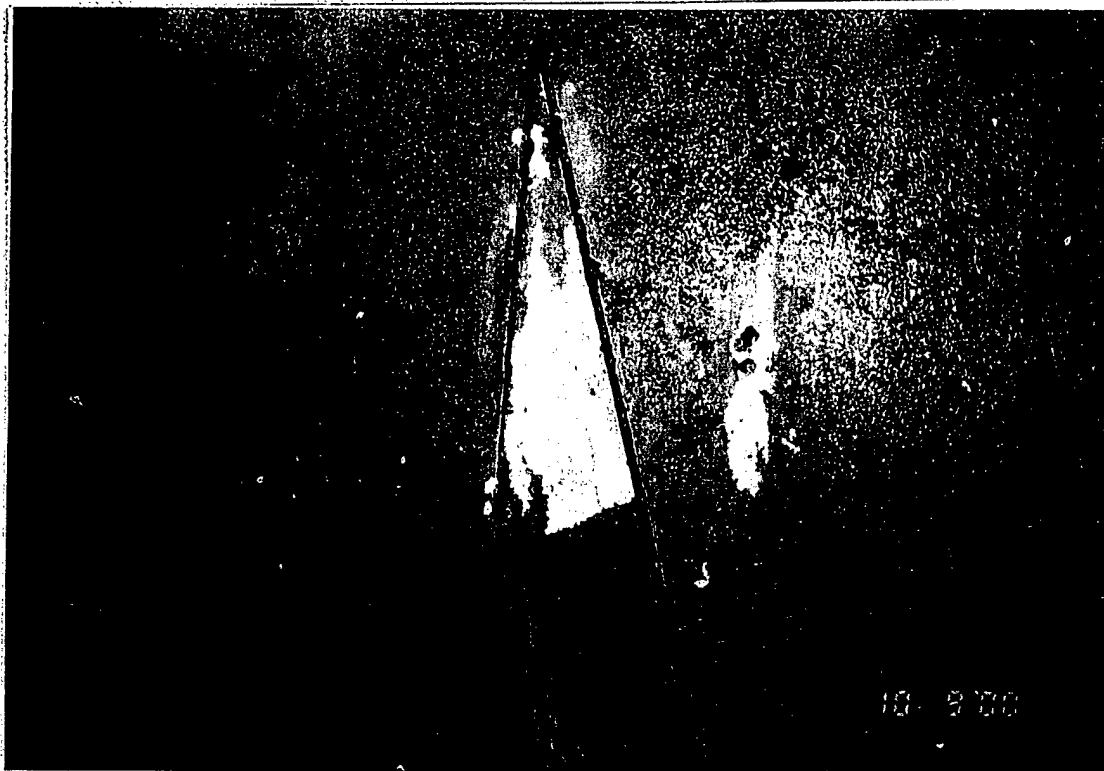


Lower
Granite
Dam

Gate 2
Downstream side of bottom seal,
typical.

10/09/00

2-29



Lower
Granite
Dam

Gate 2
Skin plate pitting, typical.

10/09/00

2-30



Lower
Granite
Dam

10/09/00

2-31

Gate 2
Waterblasting of skin plate pitting,
typical.

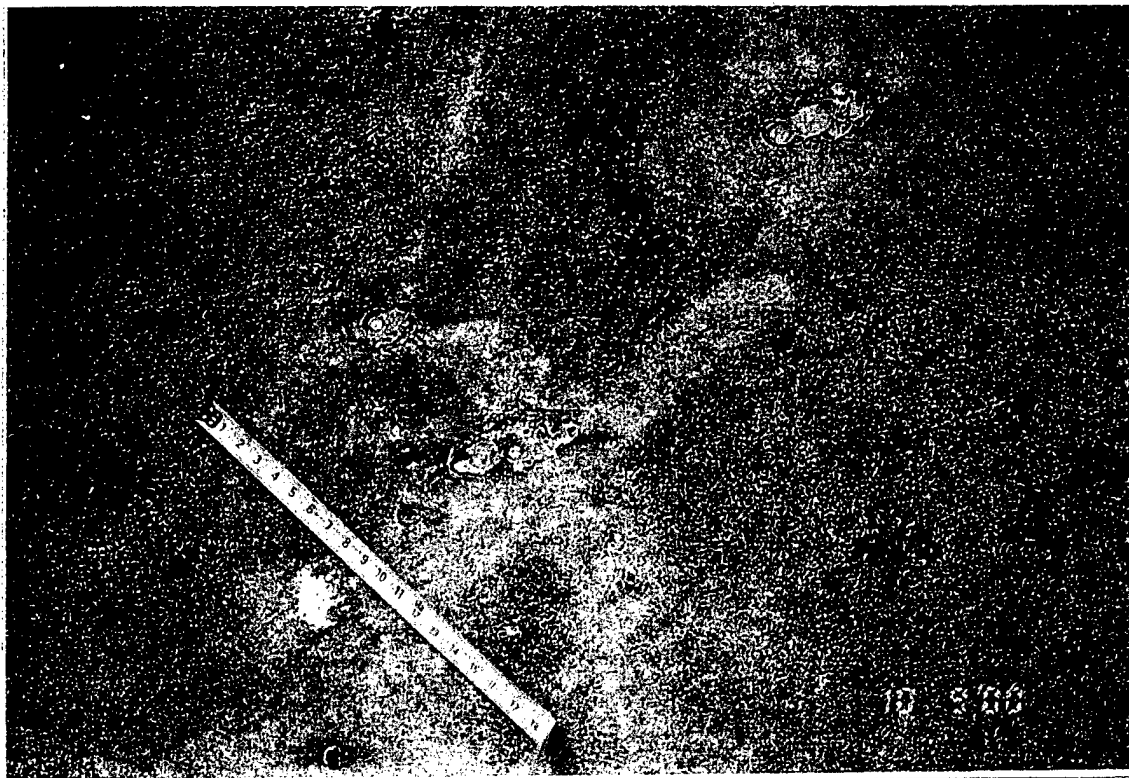


Lower
Granite
Dam

10/09/00

2-32

Gate 2
Typical pitting.



Lower
Granite
Dam

Gate 2
Typical pitting.

10/09/00

2-33

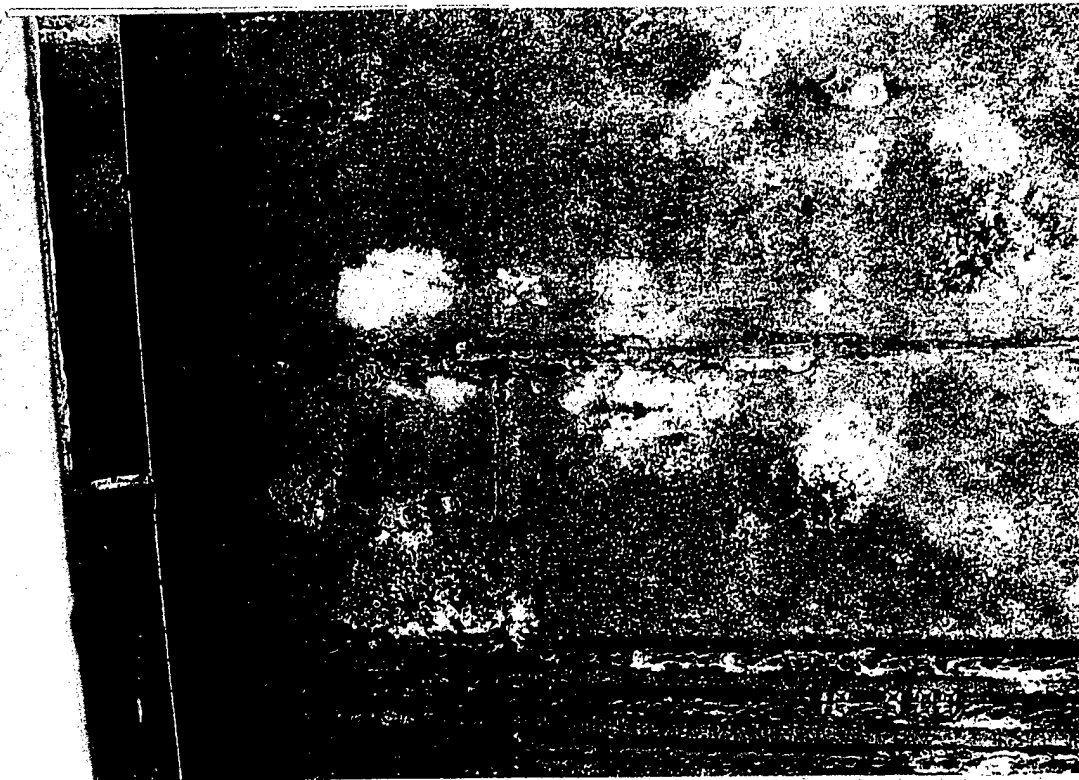


Lower
Granite
Dam

Gate 2
Typical wear plate condition. Light
grooves due to cable wear, light to
moderate corrosion.

10/09/00

2-34



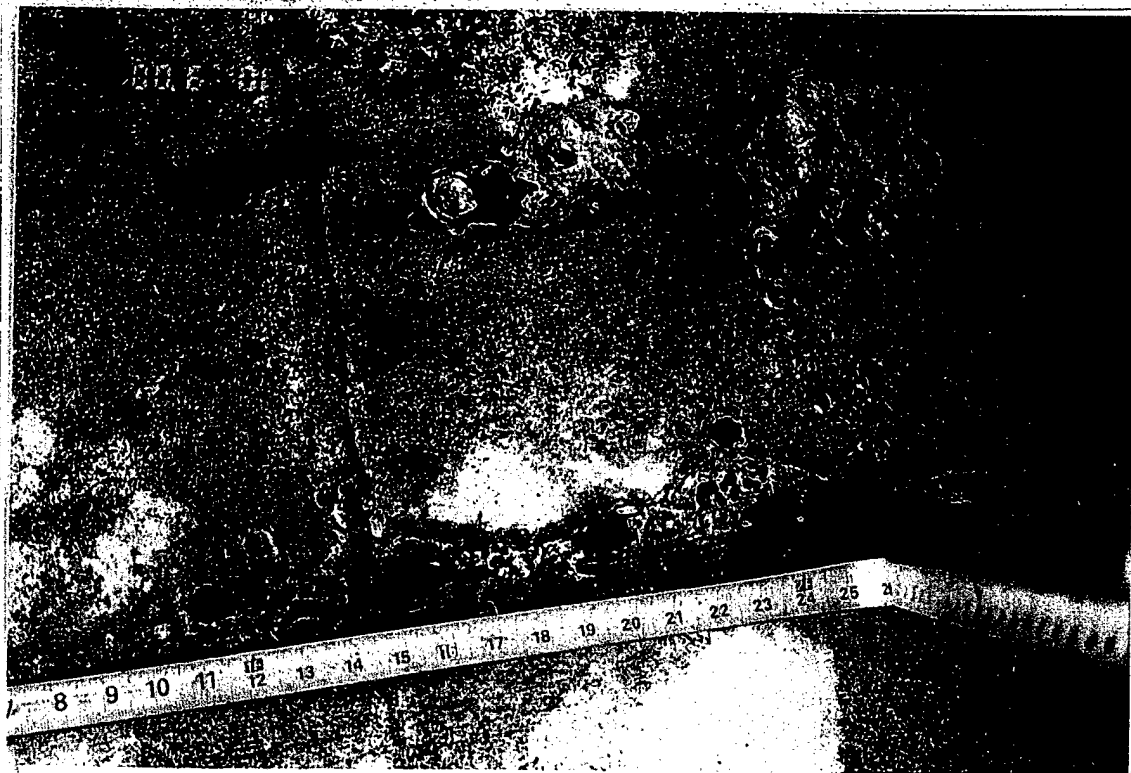
Lower
Granite
Dam

10/09/00

2-35

Gate 2

Skin plate pitting and corrosion along
construction joint weld at left side of
gate.



Lower
Granite
Dam

10/09/00

2-36

Gate 2

Close-up, skin plate pitting and
corrosion along construction joint
weld at left side of gate



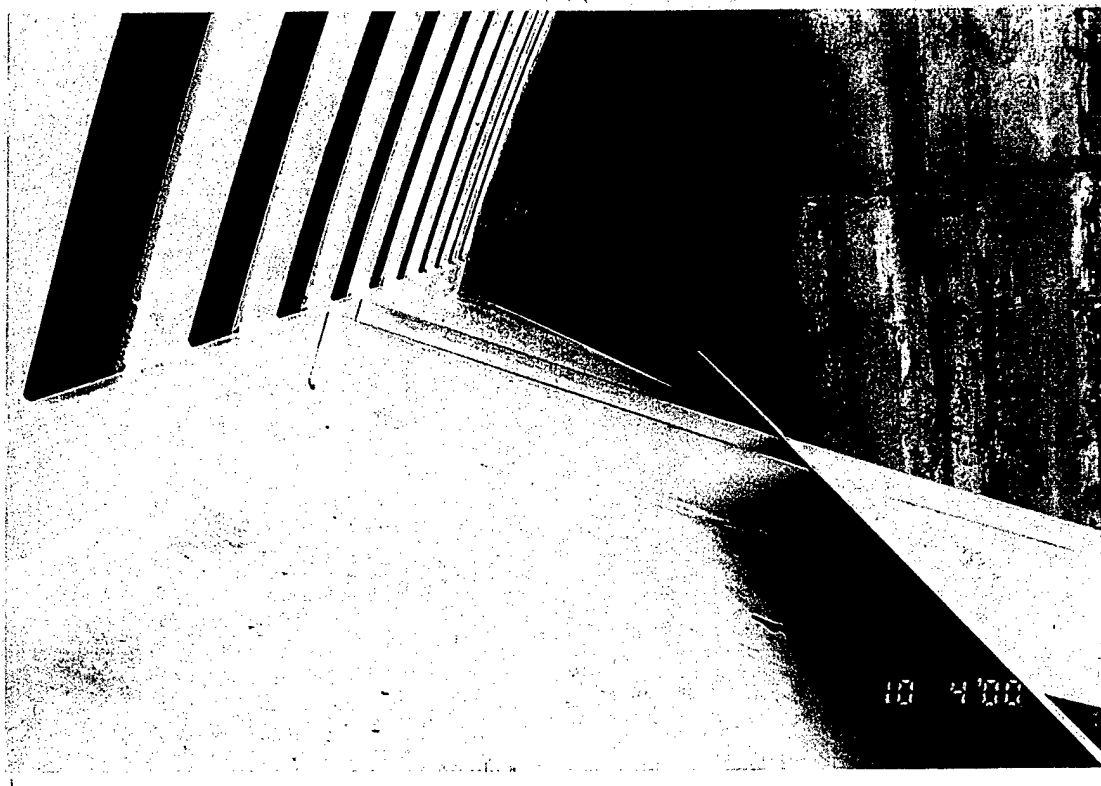
Lower
Granite
Dam

10/04/00

3-1

Gate 3

Left end of top horizontal girder.
Chipped paint and light surface
corrosion.



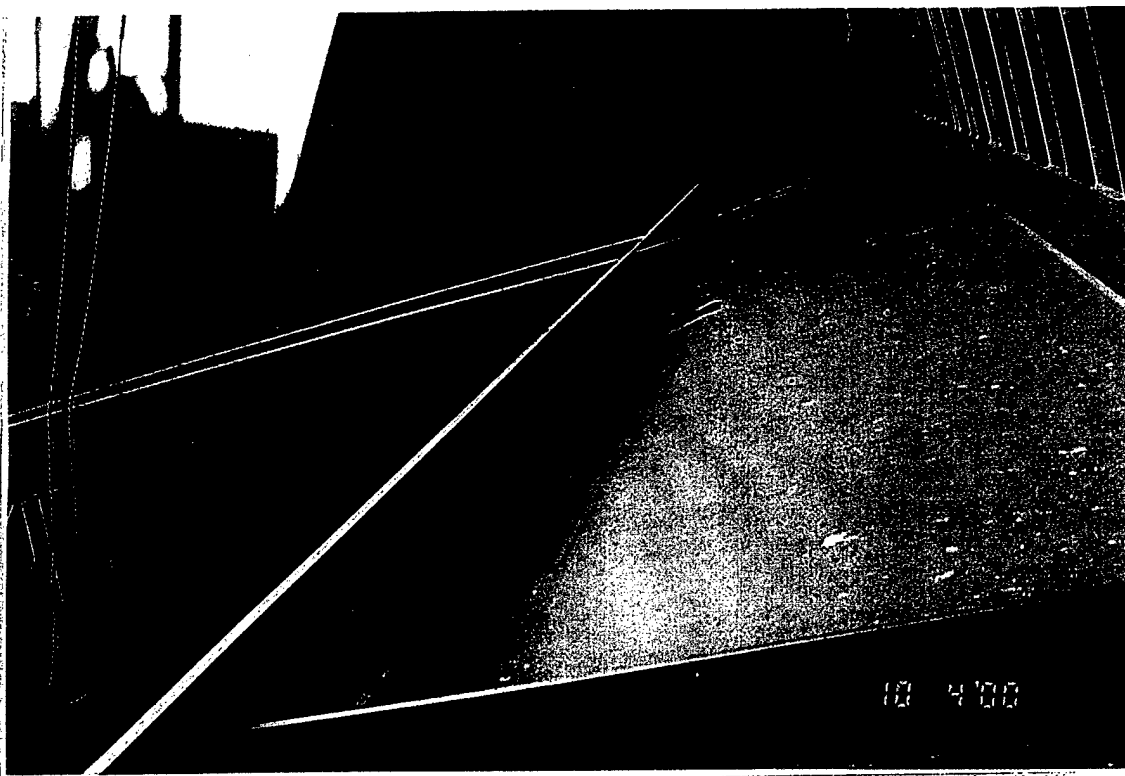
Lower
Granite
Dam

10/04/00

3-2

Gate 3

Left end of top horizontal girder.
Chipped paint and light surface
corrosion. Note: Debris line on
downstream flange of girder
indicating inadequate drainage.

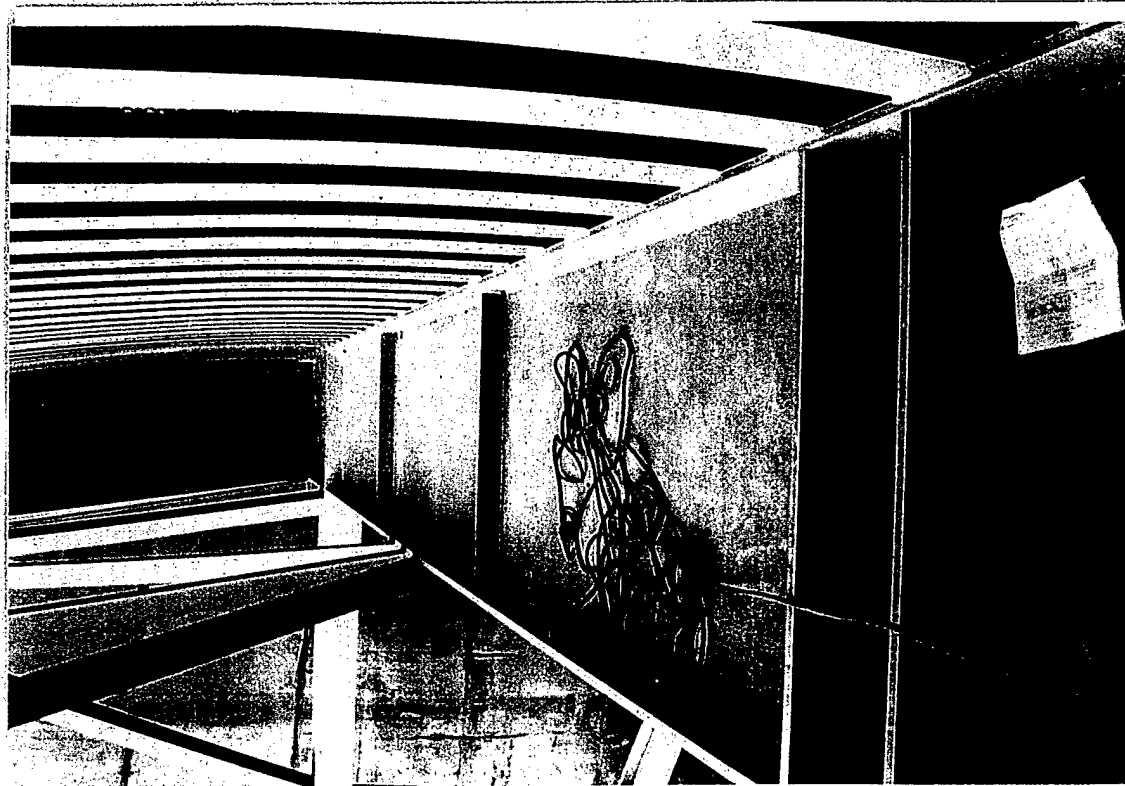


Lower
Granite
Dam

10/04/00

3-3

Gate 3
Right end of top horizontal girder,
typical.

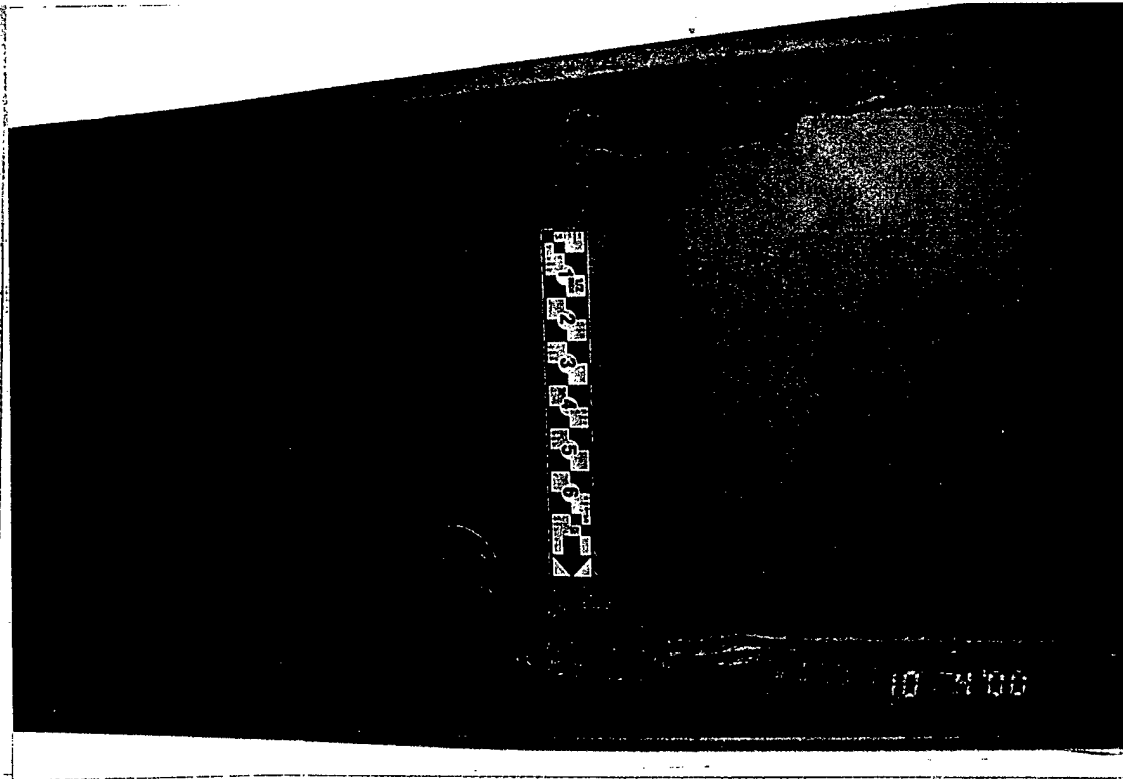


Lower
Granite
Dam

10/04/00

3-4

Gate 3
Middle horizontal girder, typical.



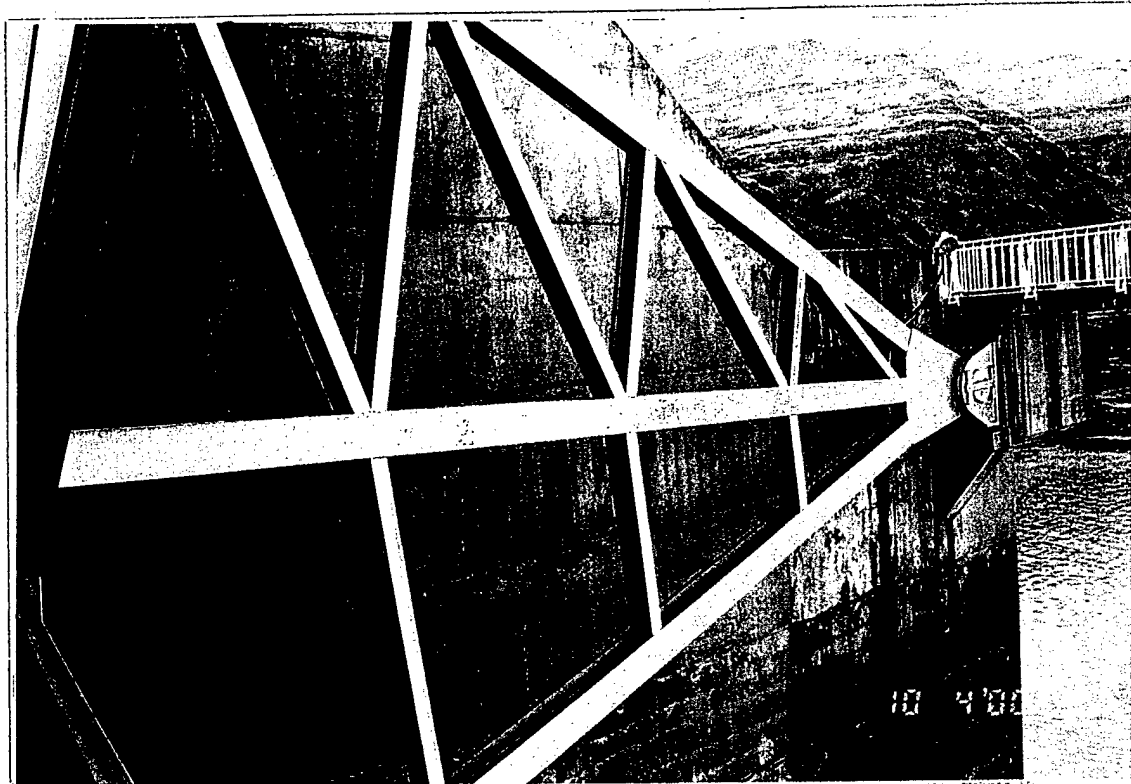
Lower
Granite
Dam

10/04/00

3-5

Gate 3

Left frame, top end of Brace H.
Coping in brace at weld to top radial
strut, typical.



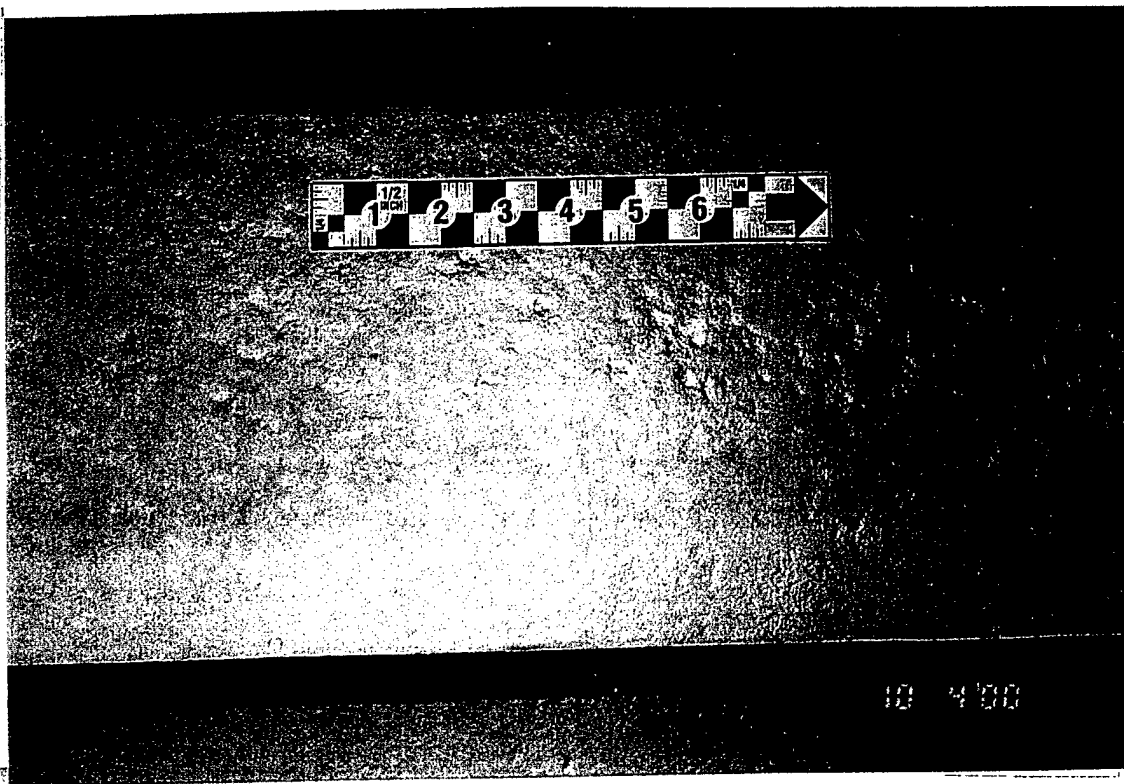
Lower
Granite
Dam

10/04/00

3-6

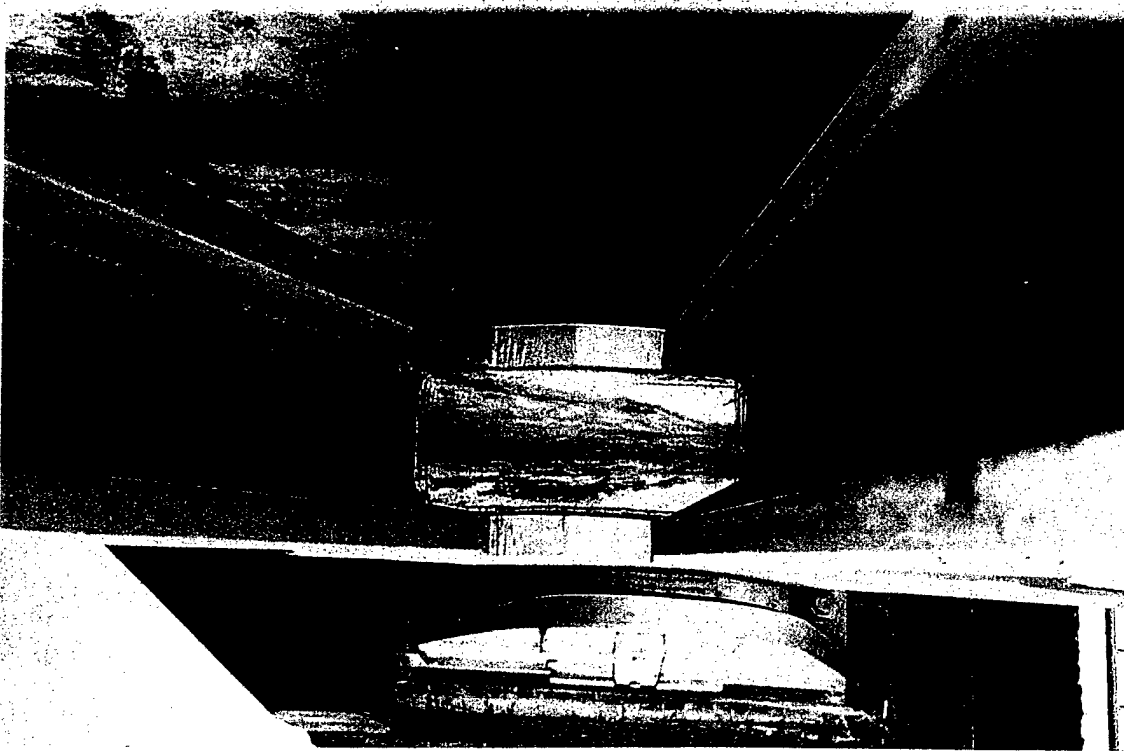
Gate 3

Left frame, typical.



Lower
Granite
Dam
10/04/00
3-7

Gate 3
Skin plate approx. 5' above middle
horiz. girder, near left frame. Small
pitting in skin plate, < 1/6" deep.



Lower
Granite
Dam
10/04/00
3-8

Gate 3
Inside closure plate at right trunnion,
looking downstream. Staining and
light corrosion due to drain above.

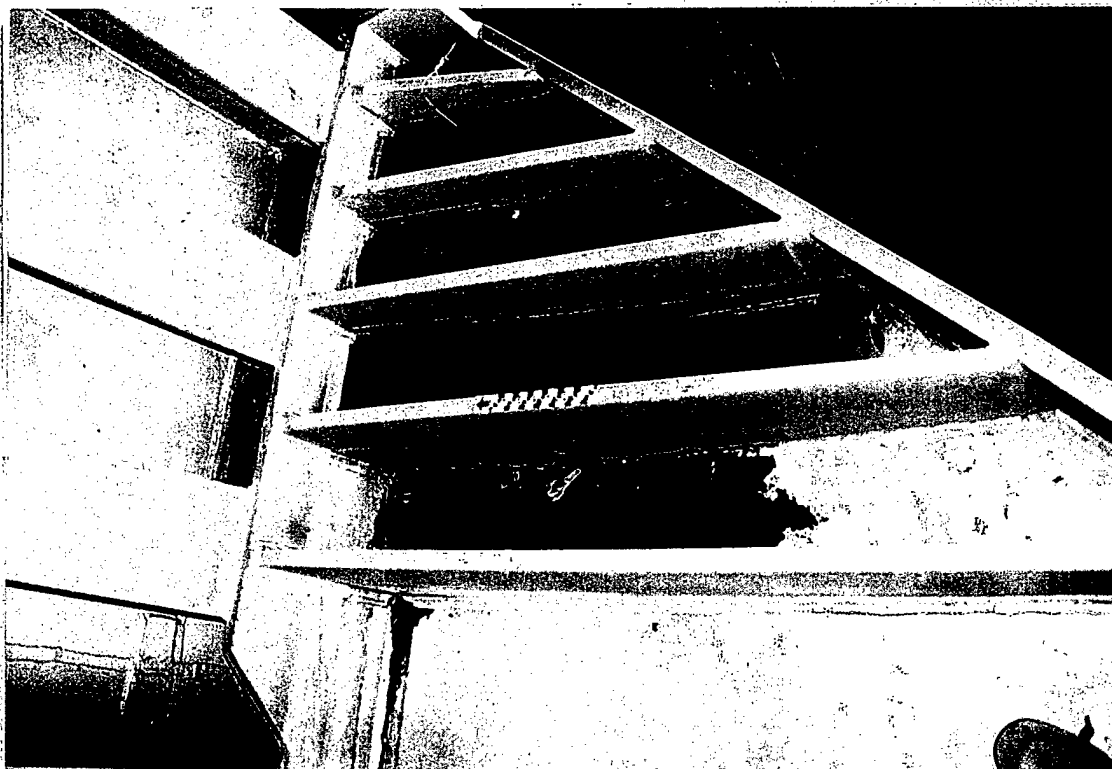


Lower
Granite
Dam

10/04/00

3-9

Gate 3
Outside of left trunnion and yoke,
looking downstream. Note:
lubrication lines and expelled
lubrication beneath trunnion.

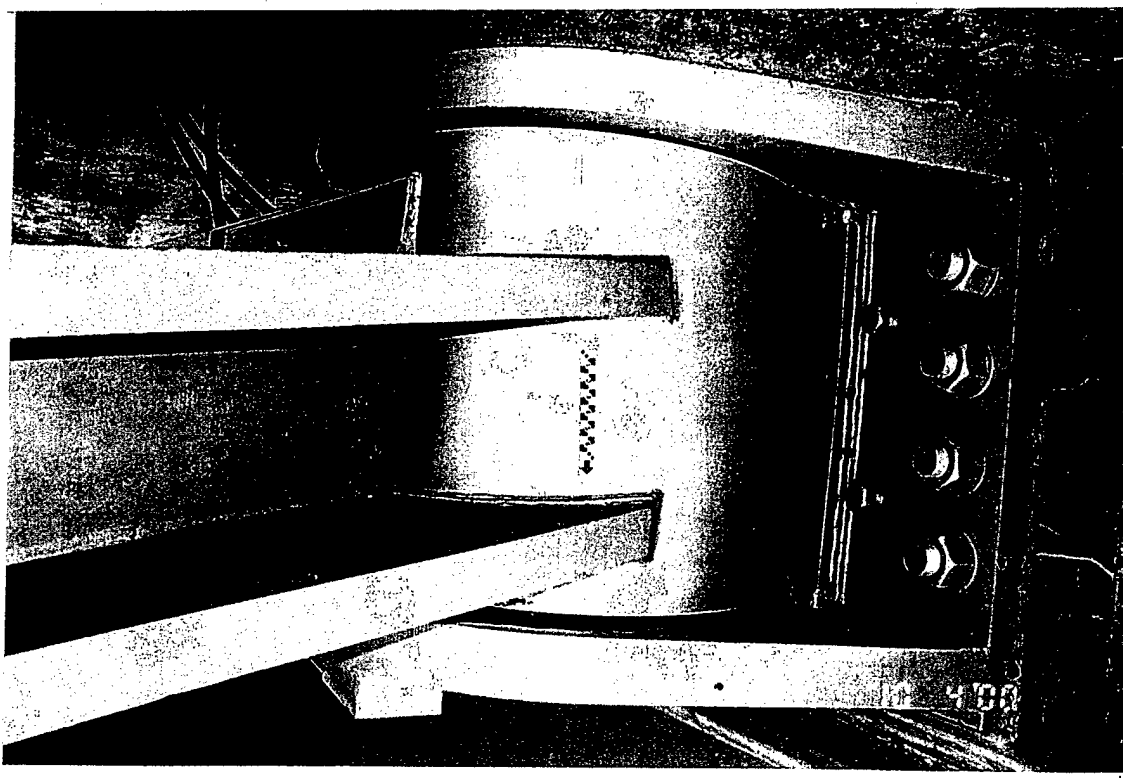


Lower
Granite
Dam

10/04/00

3-10

Gate 3
Left end of bottom horizontal girder.
Standing water, no drainage between
multiple stiffeners. Horizontal girder
to skin plate stiffeners, debris and no
drainage

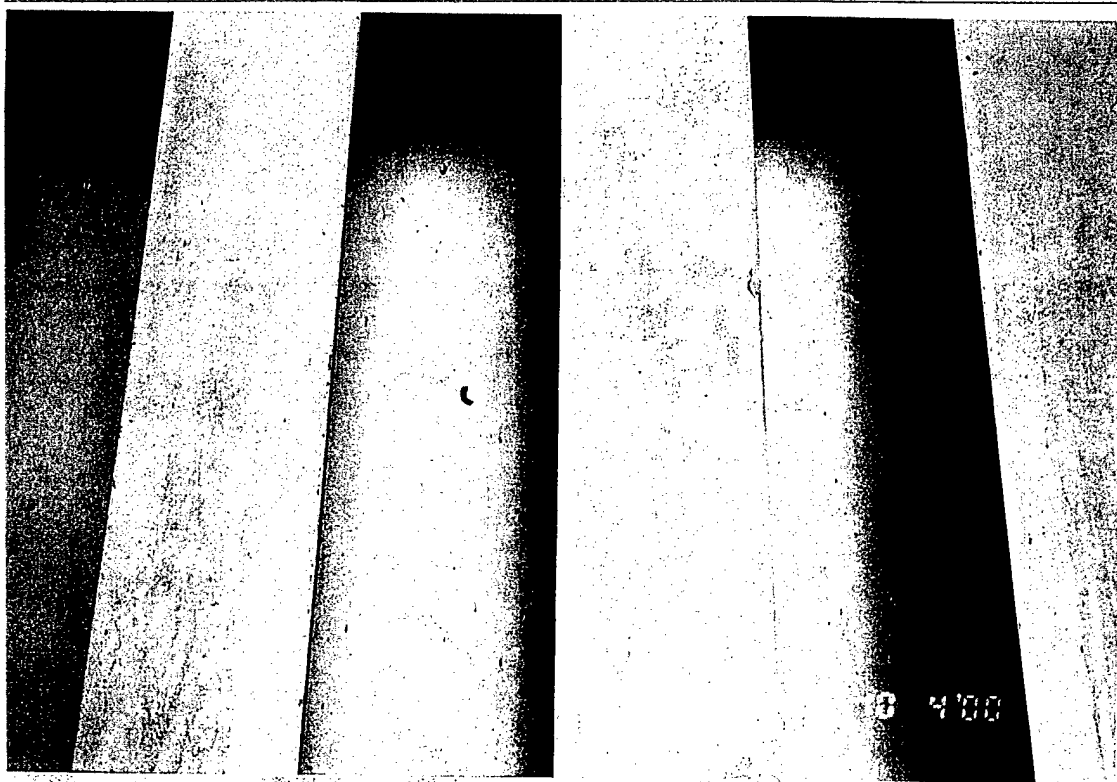


Lower
Granite
Dam

Gate 3
Top of left trunnion, typical.

10/04/00

3-11

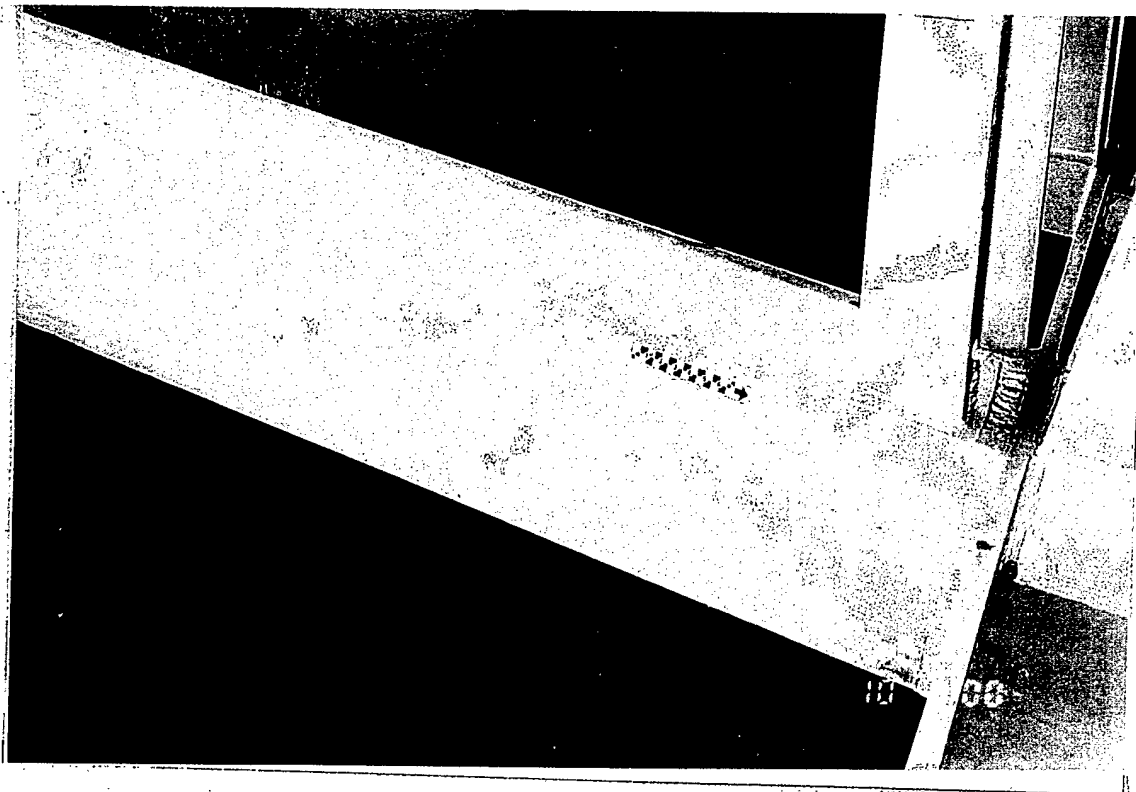


Lower
Granite
Dam

Gate 3
Purlins and skin plate, typical.

10/04/00

3-12



Lower
Granite
Dam

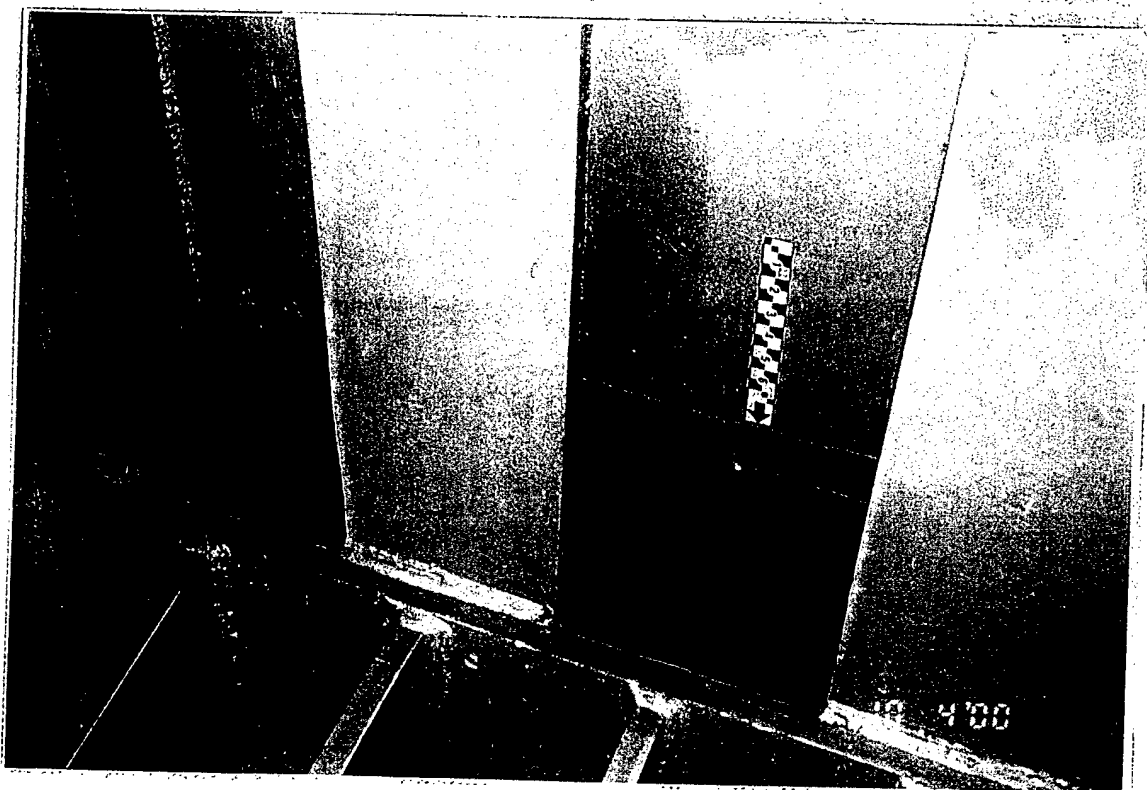
10/04/00

3-13

Gate 3

Upstream end of right frame, bottom
radial strut. Grind marks in flange.

Note: Discoloration at welded joint
to girder due to ultrasonic weld test
gel.



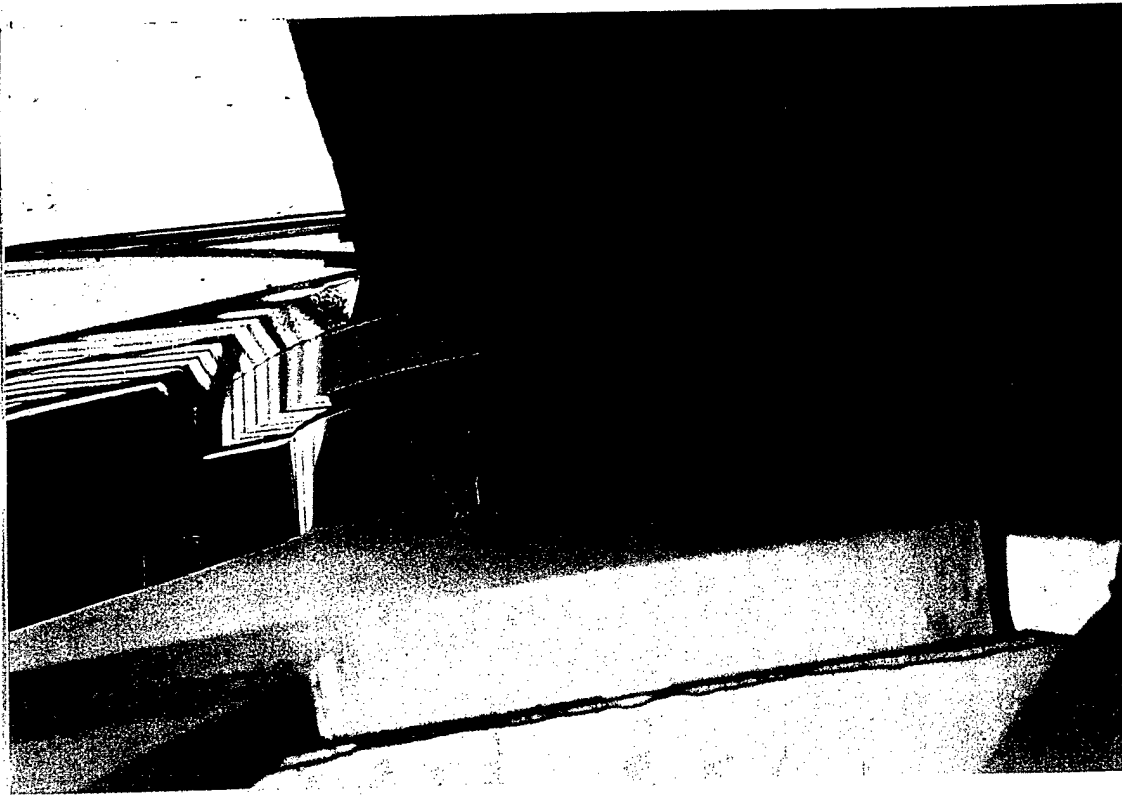
Lower
Granite
Dam

10/04/00

3-14

Gate 3

Right end of bottom horizontal
girder. Horizontal girder to skin
plate stiffeners, standing water,
debris and no drainage

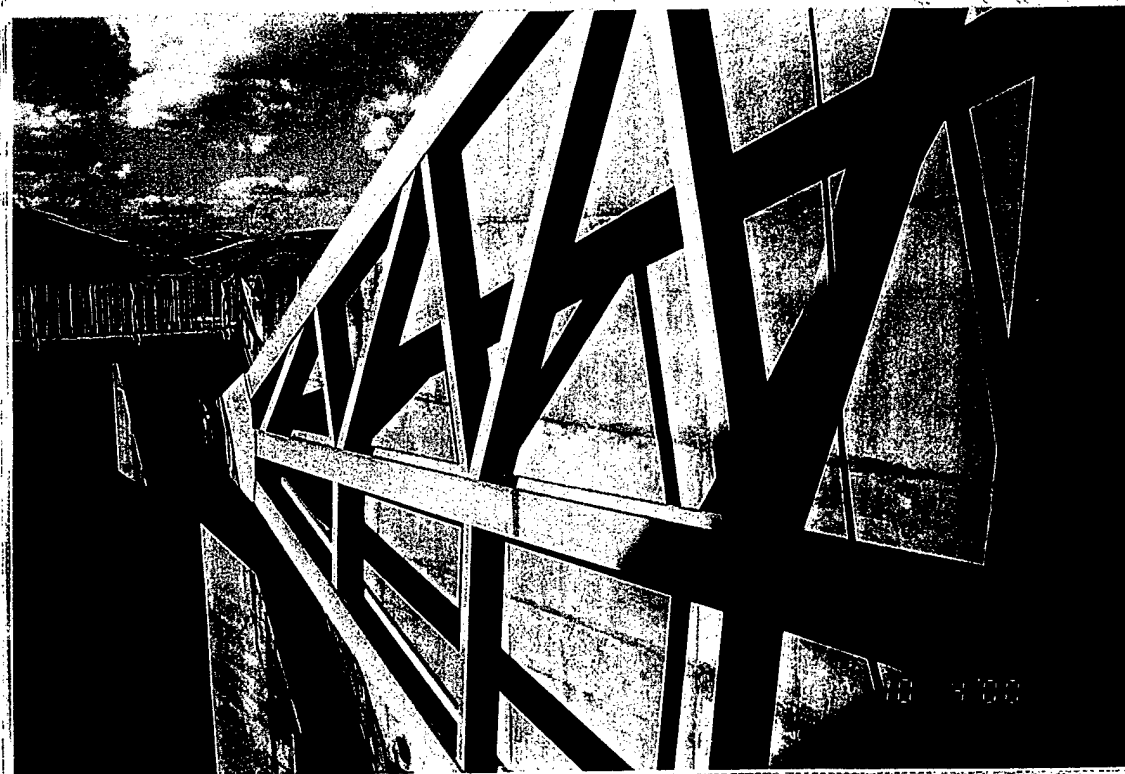


Lower
Granite
Dam

10/04/00

3-15

Gate 3
Outside of right trunnion and yoke
looking downstream, typical.

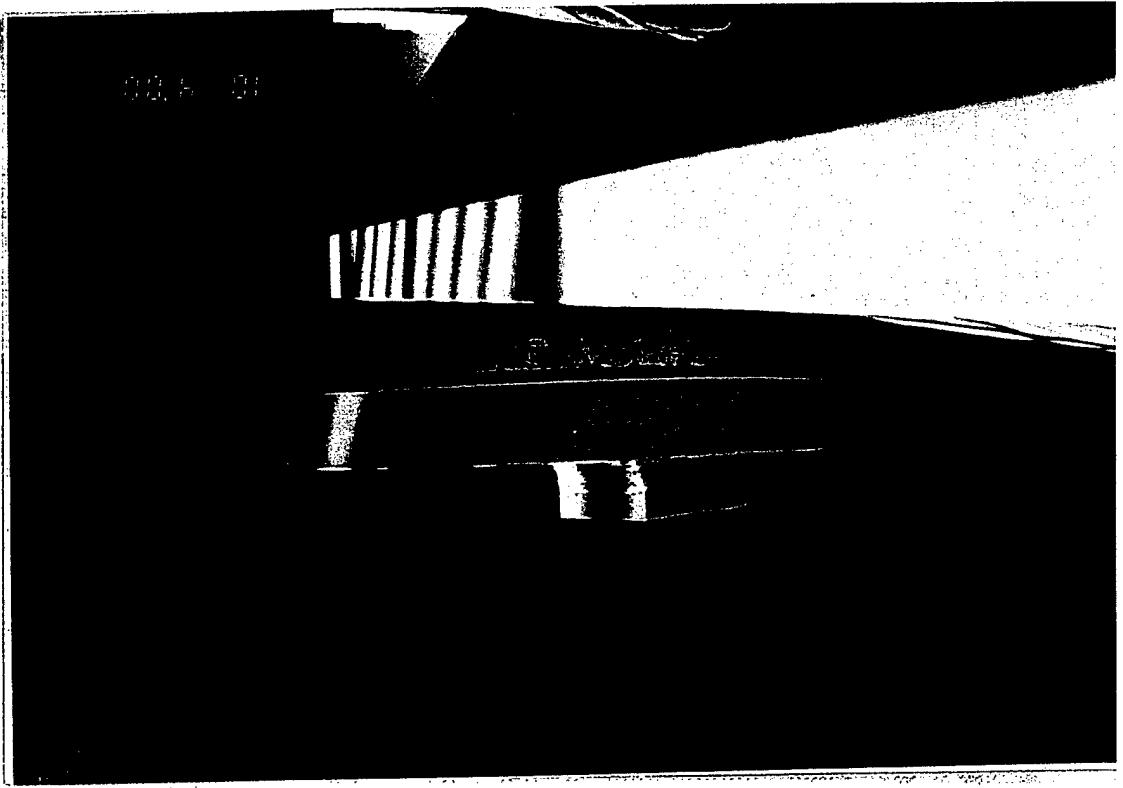


Lower
Granite
Dam

10/04/00

3-16

Gate 3
Right frame, typical.

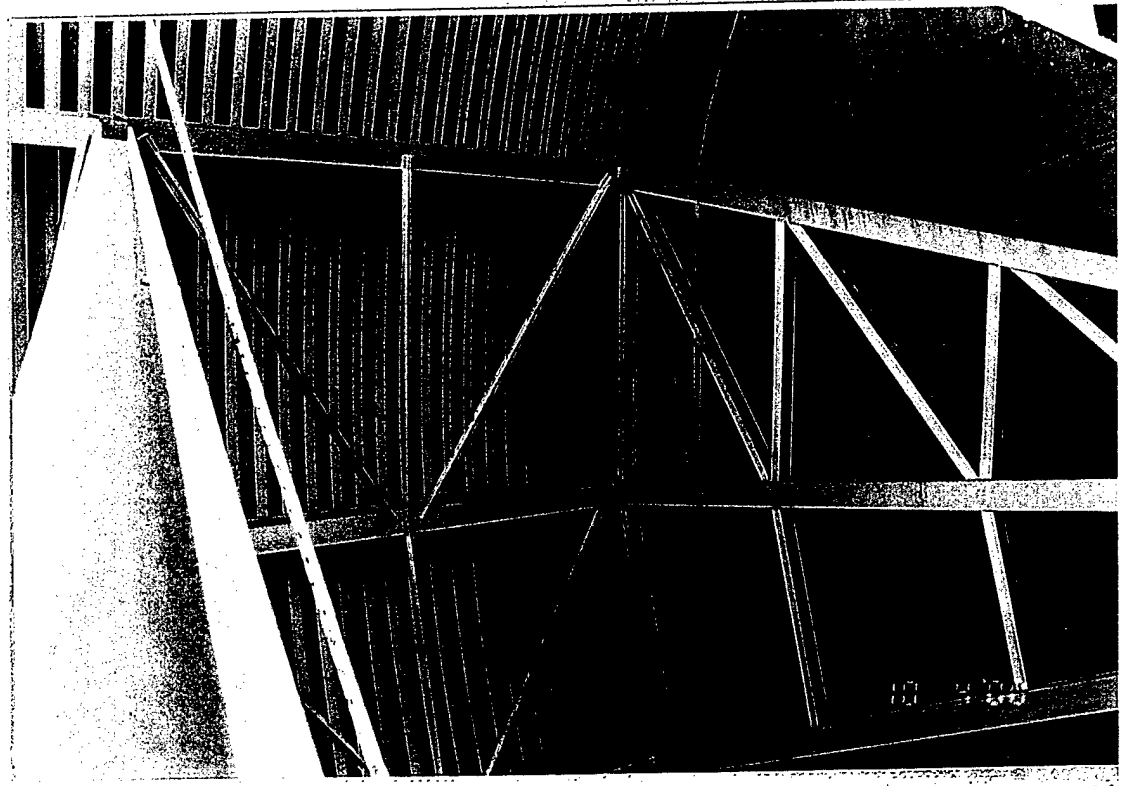


Lower
Granite
Dam

10/04/00

3-17

Gate 3
Right trunnion and yoke looking
downstream. Light corrosion on
trunnion.

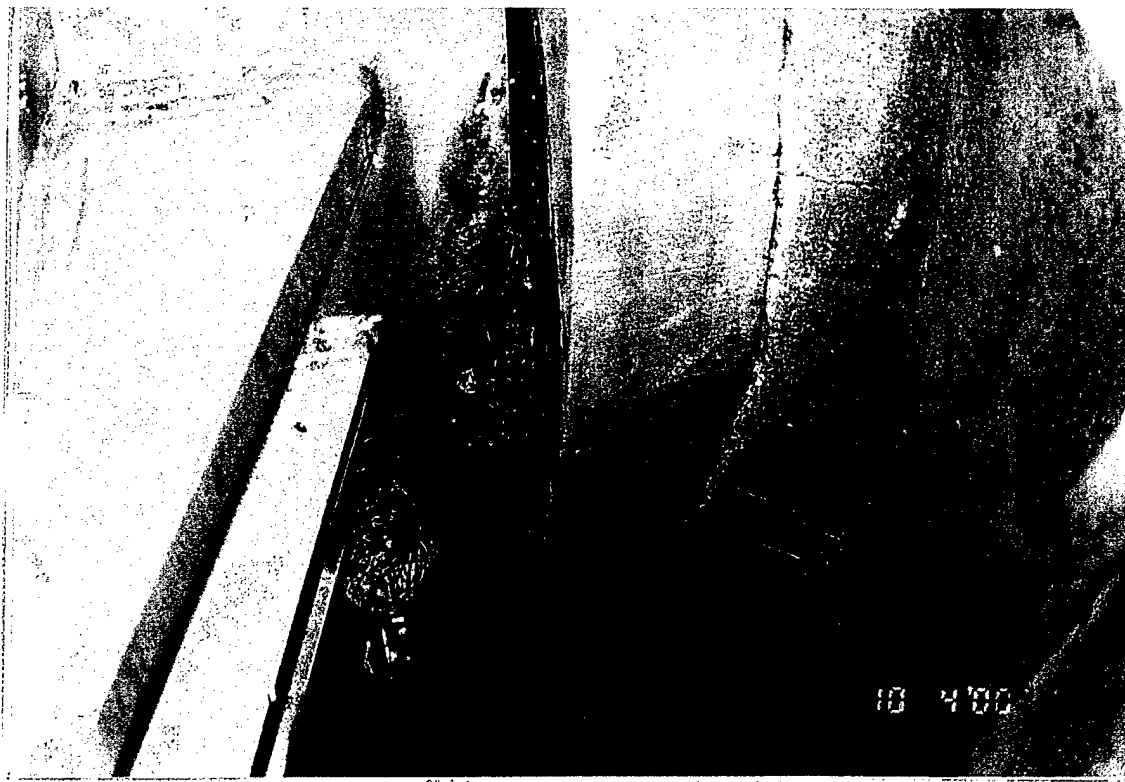


Lower
Granite
Dam

10/04/00

3-18

Gate 3
Gate face and left frame, typical.



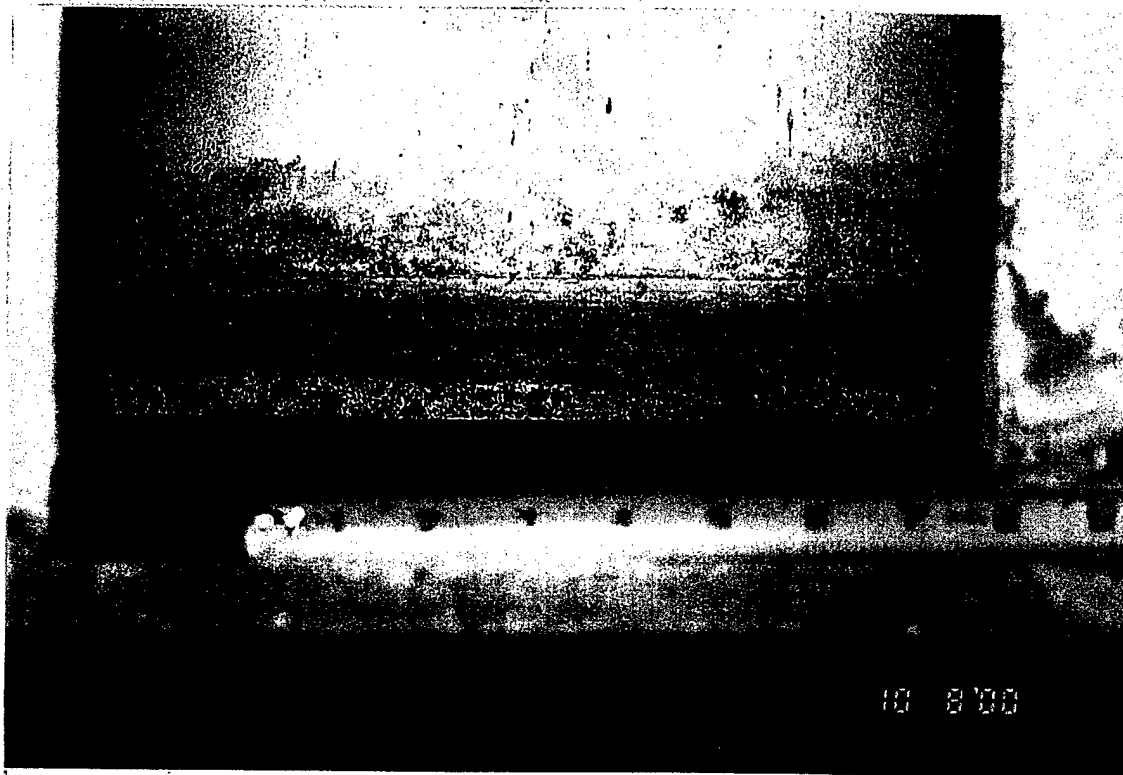
Lower
Granite
Dam

10/04/00

3-19

Gate 3

Close-up of upstream side of right trunnion and yoke. Note: Small lubrication leak at connection to trunnion.



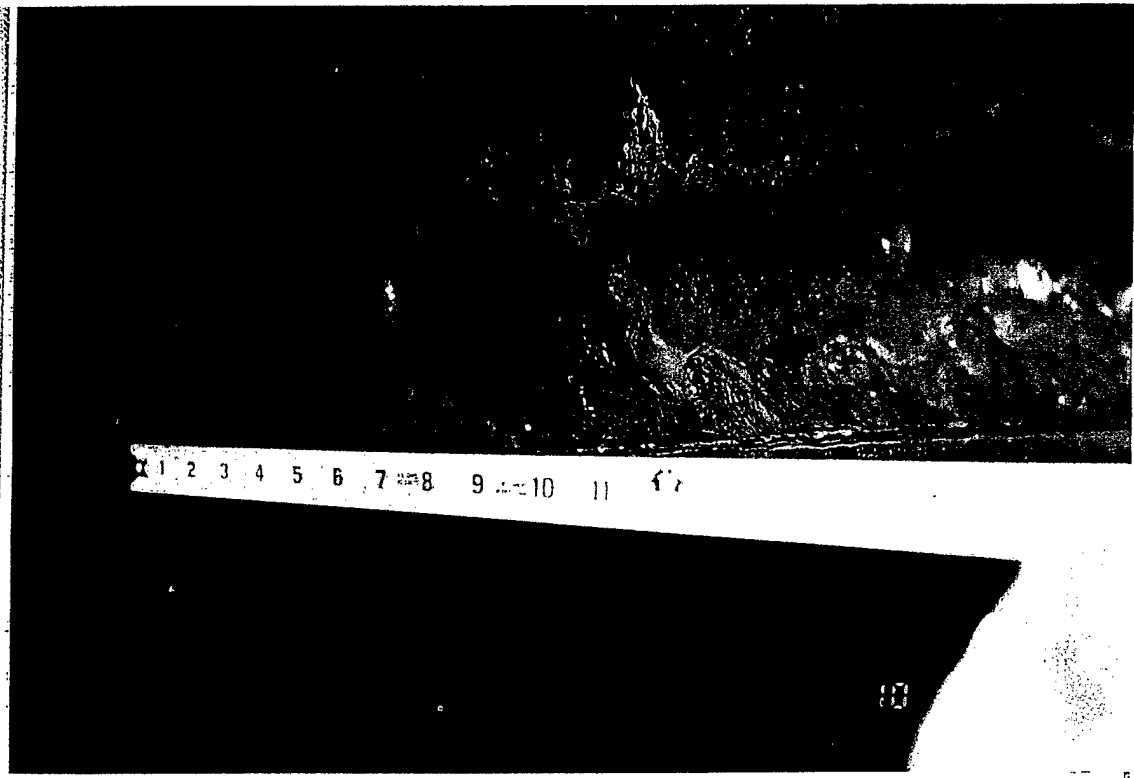
Lower
Granite
Dam

10/08/00

3-20

Gate 3

Bottom seal closure plate looking upstream. Standing water between closure plate, purlin webs and skinplate. Typical.



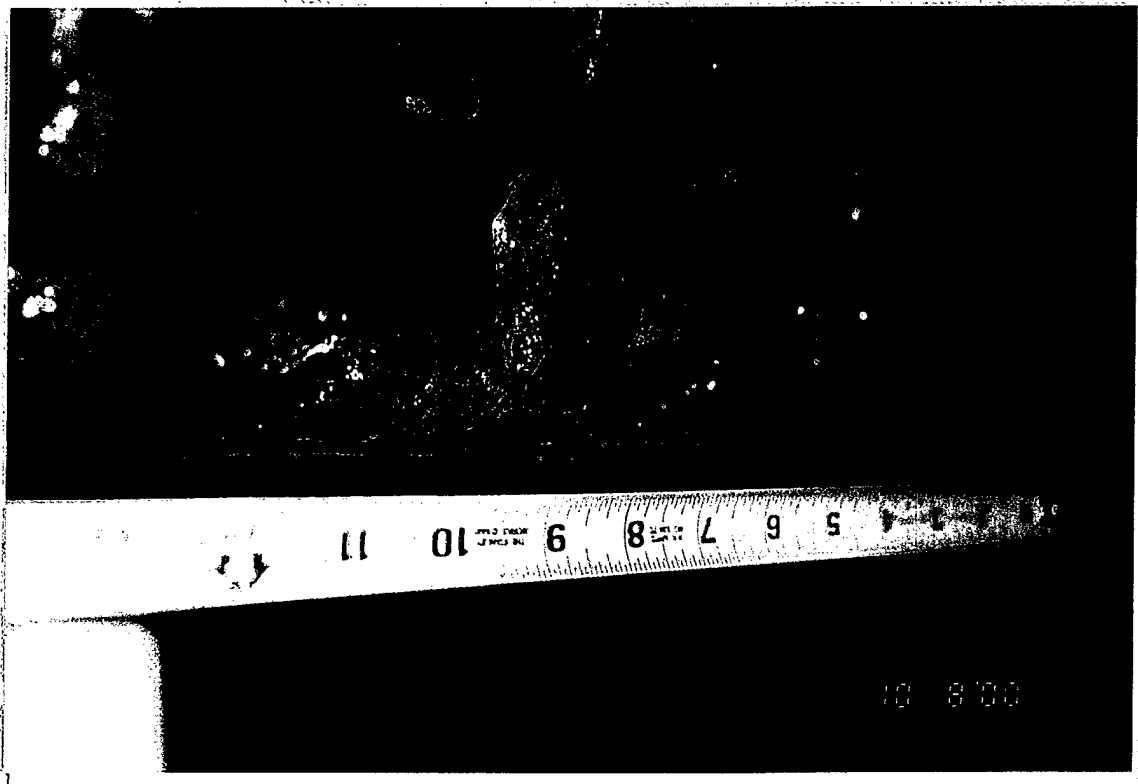
Lower
Granite
Dam

10/08/00

3-21

Gate 3

Upstream side of skin plate at
bottom seal. Light to moderate
corrosion of skin plate, typical.



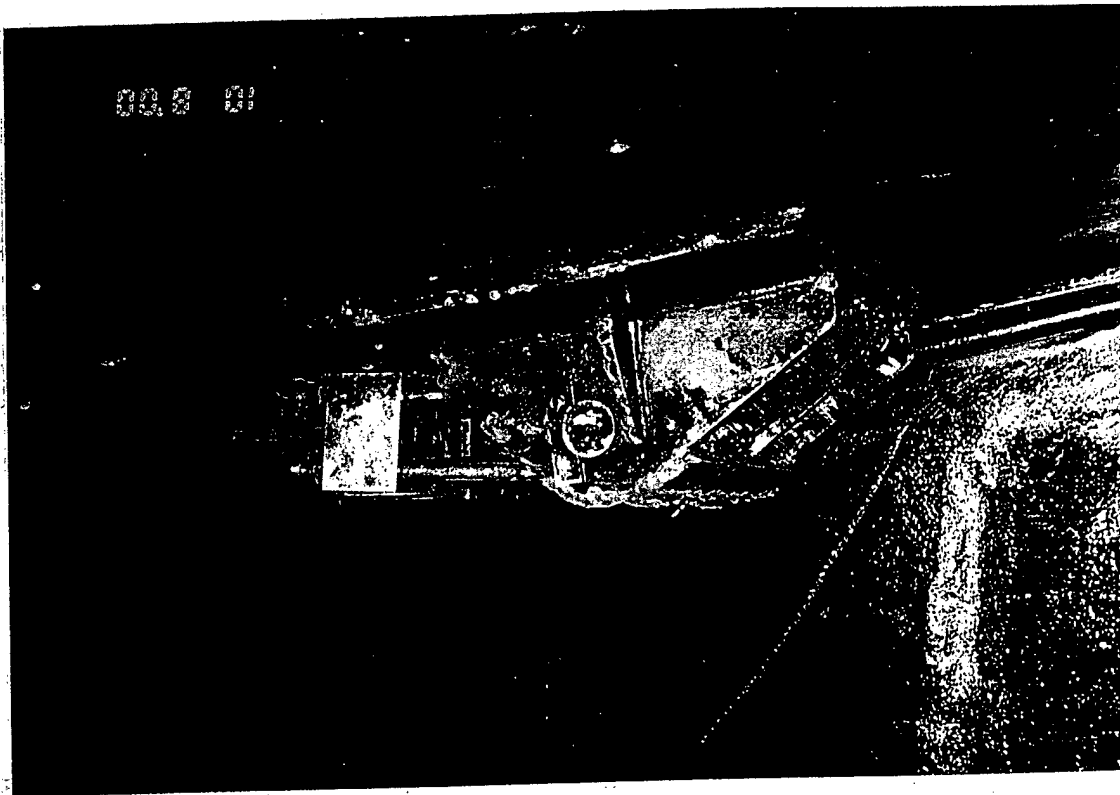
Lower
Granite
Dam

10/08/00

3-22

Gate 3

Upstream side of skin plate at
bottom seal. Light to moderate
corrosion of skin plate, typical.



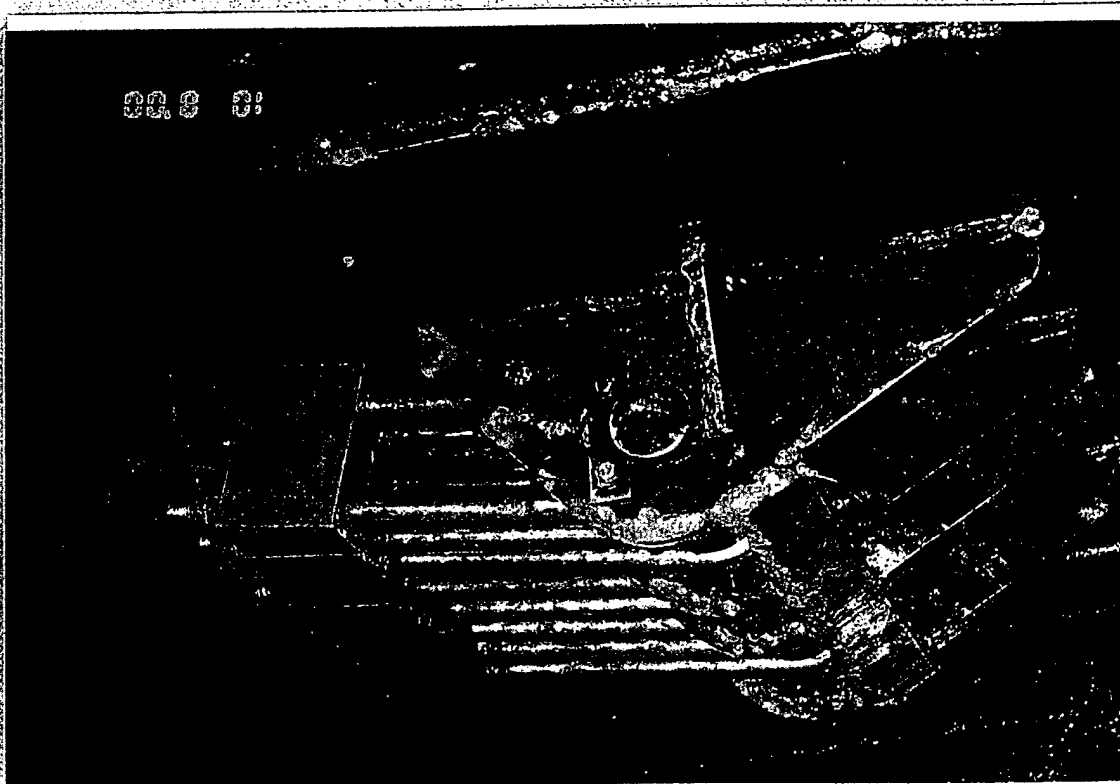
Lower
Granite
Dam

10/08/00

3-23

Gate 3

Left side hoist connection. Light corrosion on lifting lugs and plates.
Note: excellent condition of stainless steel U-bolts.



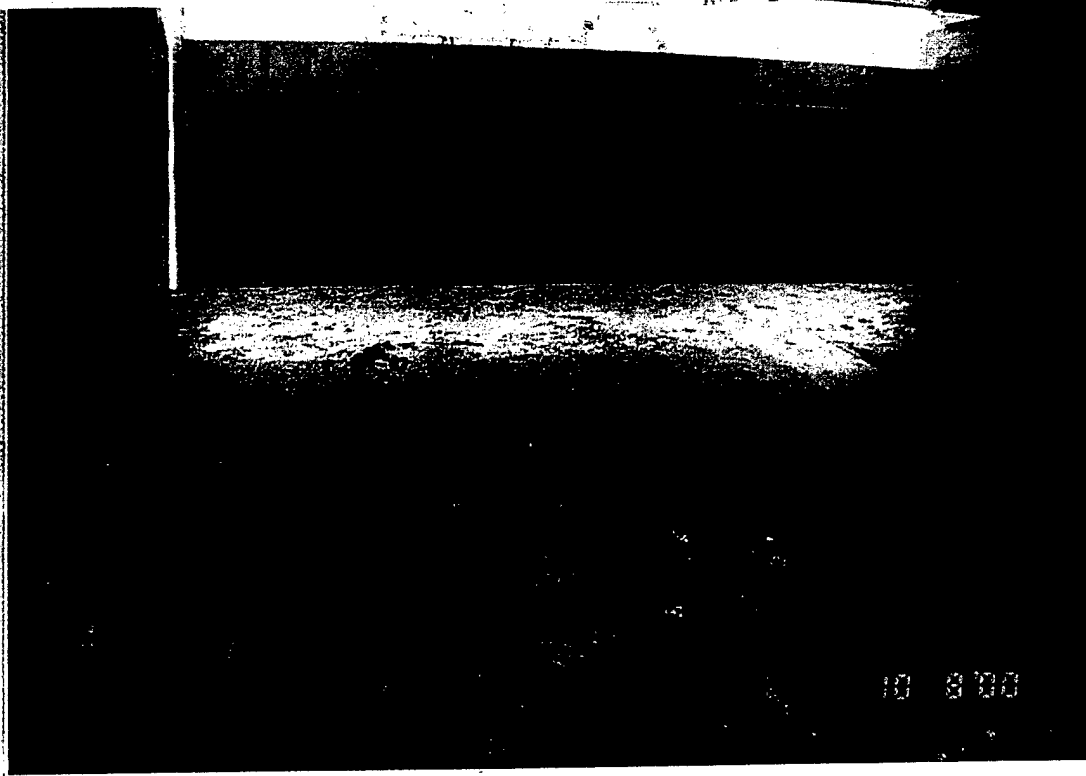
Lower
Granite
Dam

10/08/00

3-24

Gate 3

Left side hoist connection. Light corrosion on lifting lugs and plates.
Note: excellent condition of stainless steel U-bolts.

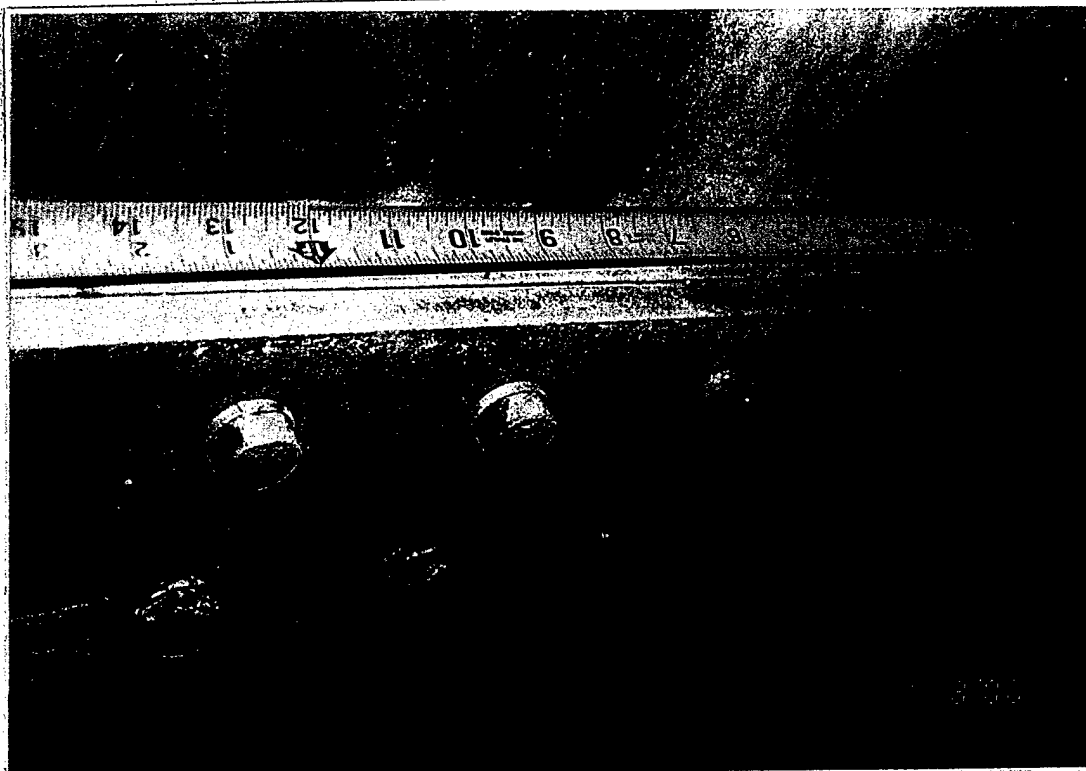


Lower
Granite
Dam

10/08/00

3-25

Gate 3
Skin plate pitting, looking up,
typical.



Lower
Granite
Dam

10/08/00

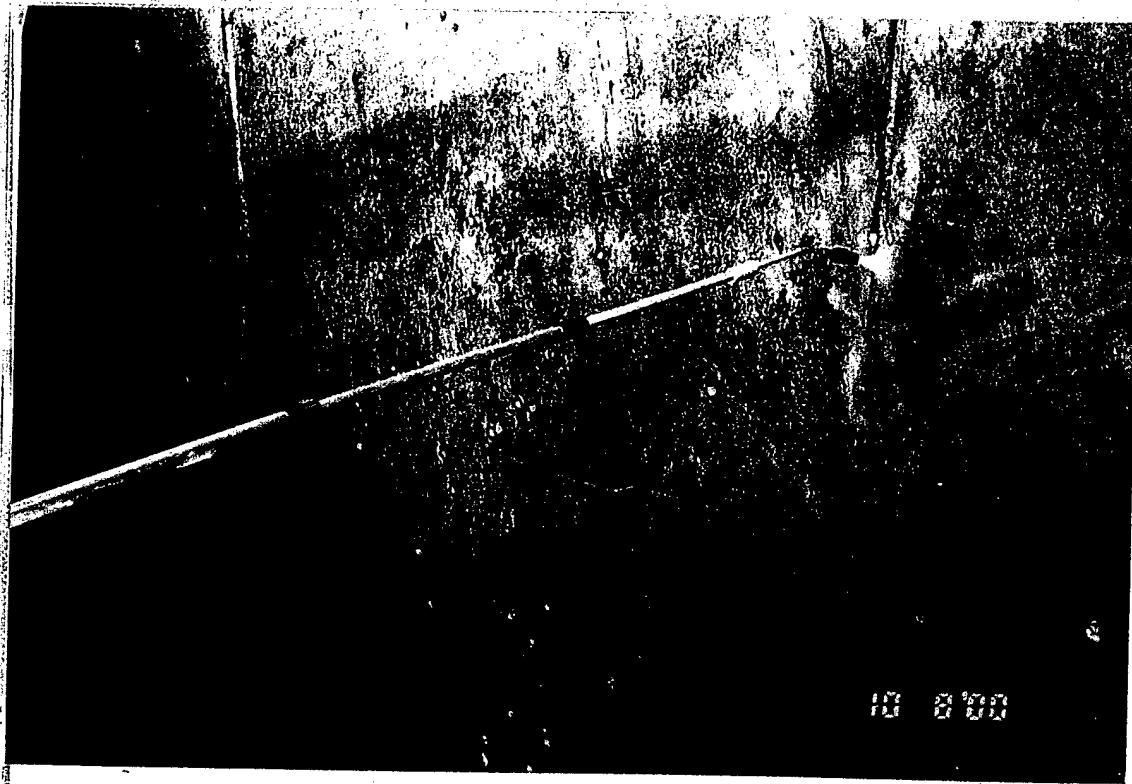
3-26

Gate 3
Downstream side of bottom seal and
keeper plate looking upstream.



Lower Gate 3
Granite Bottom seal closure plate looking
Dam upstream. Standing water between
closure plate, purlin webs and
10/08/00 skinplate. Typical.

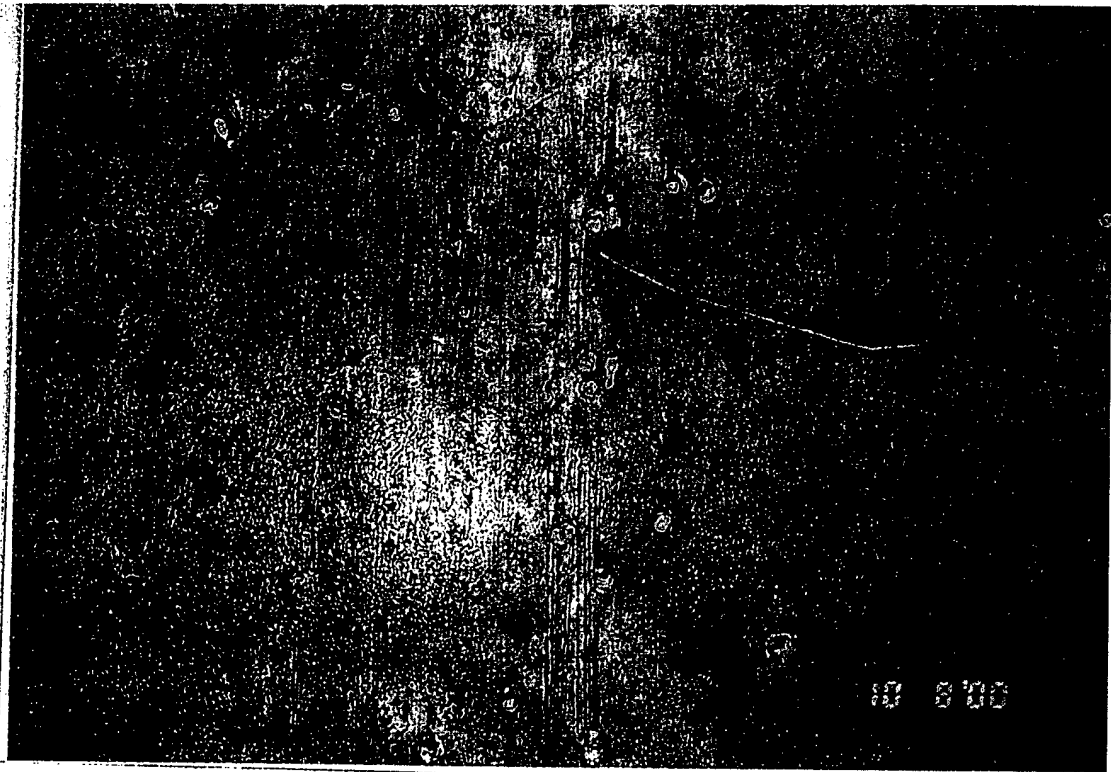
3-27



Lower Gate 3
Granite Waterblasting and typical skin plate
Dam condition.

10/08/00

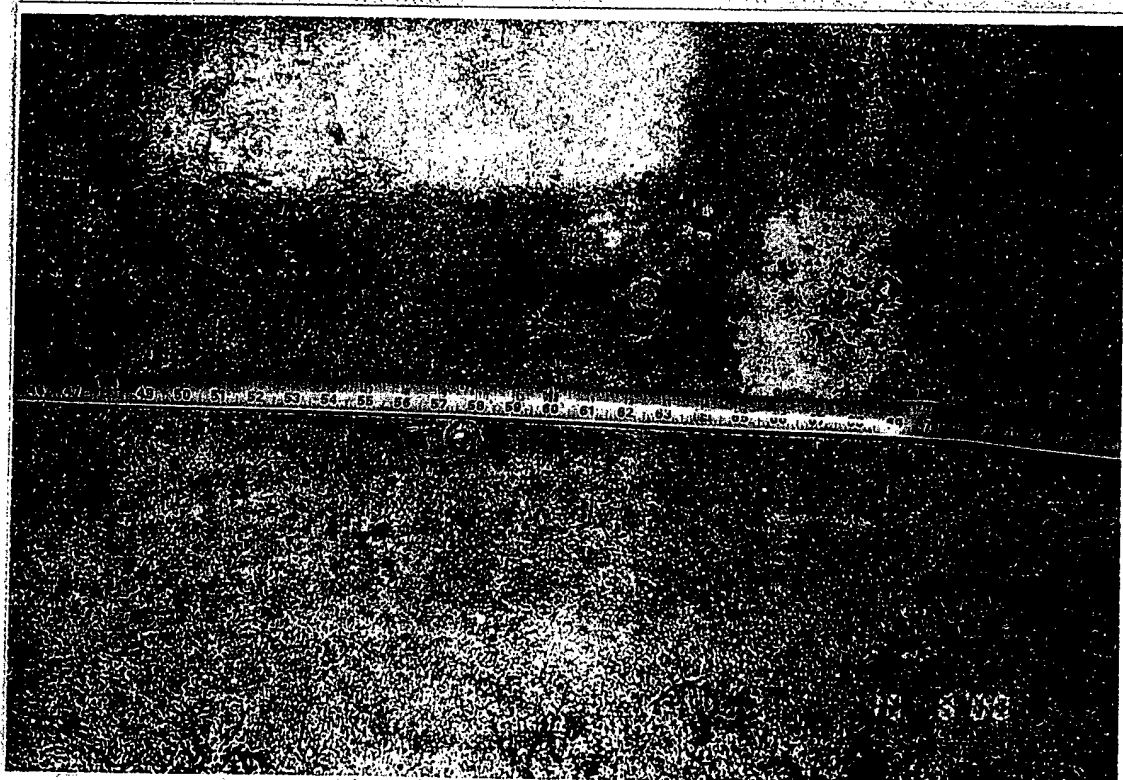
3-28



Lower Gate 3
Granite Skin plate pitting, typical.
Dam

10/08/00

3-29



Lower Gate 3
Granite Skin plate pitting, typical.
Dam

10/08/00

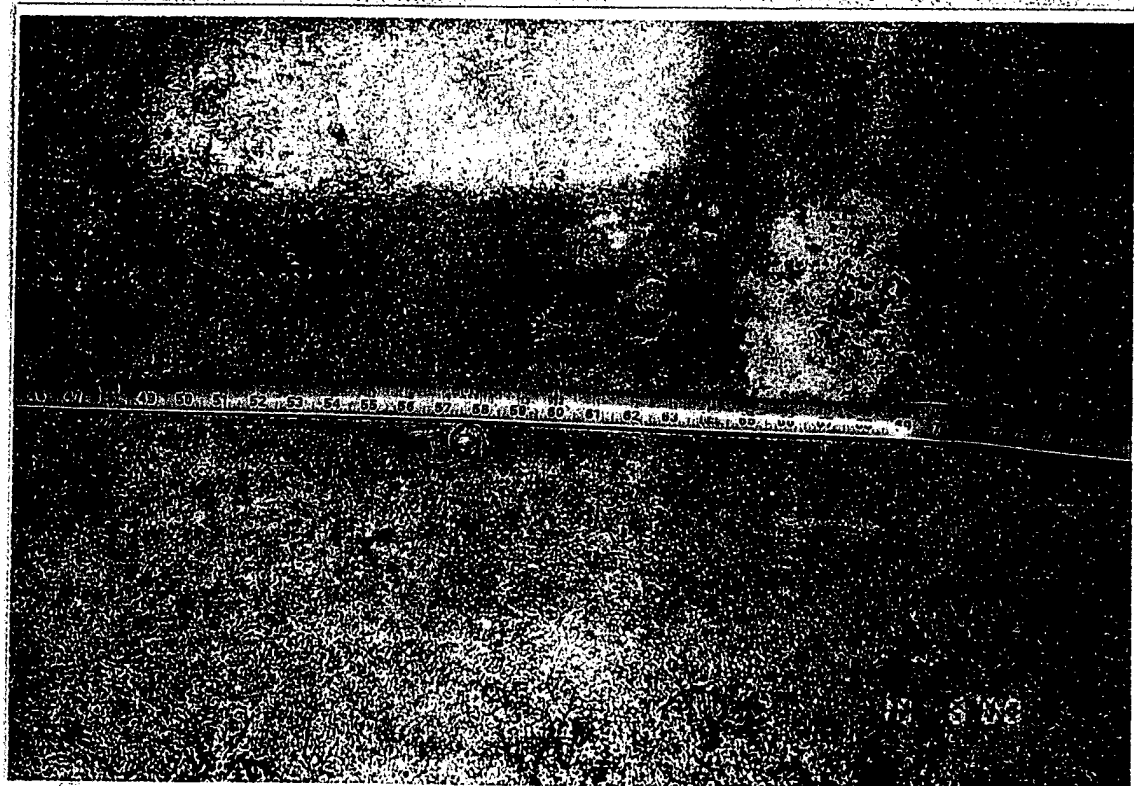
3-30



Lower Gate 3
Granite Skin plate pitting, typical.
Dam

10/08/00

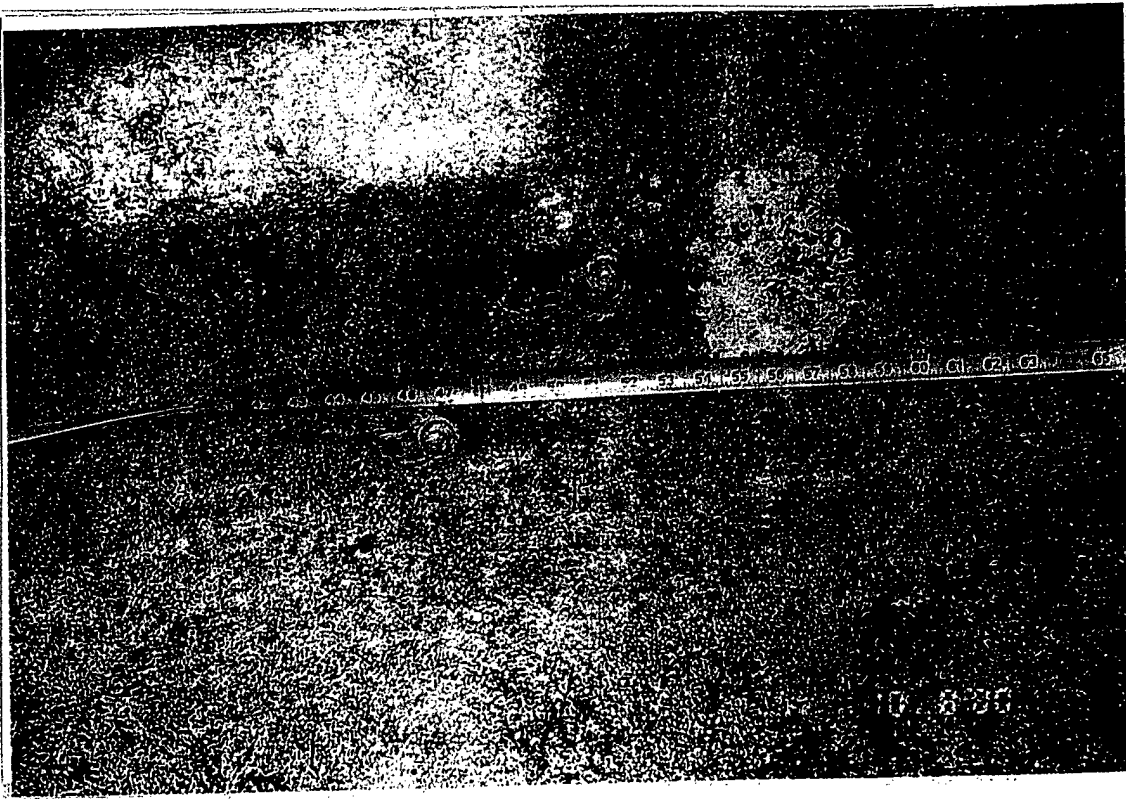
3-29



Lower Gate 3
Granite Skin plate pitting, typical.
Dam

10/08/00

3-30

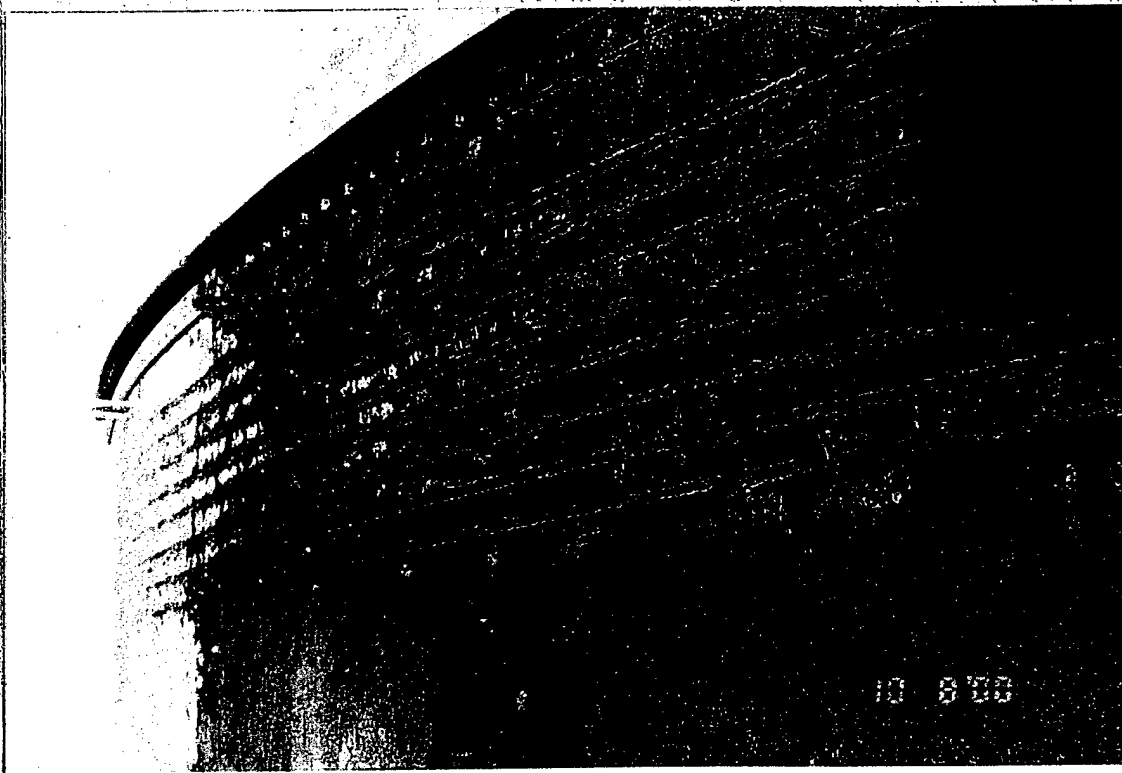


Lower
Granite
Dam

10/08/00

3-31

Gate 3
Skin plate pitting, typical.

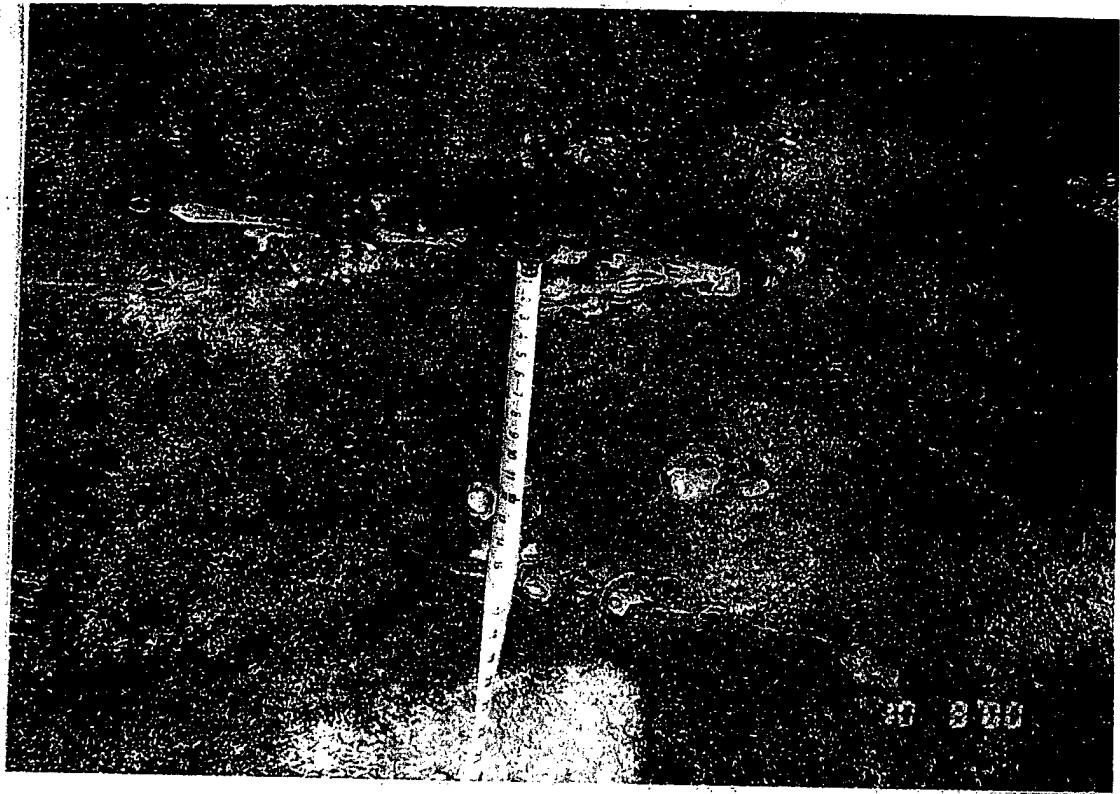


Lower
Granite
Dam

10/08/00

3-32

Gate 3
Typical wear plate condition. Light
grooves due to cable wear, light to
moderate corrosion.

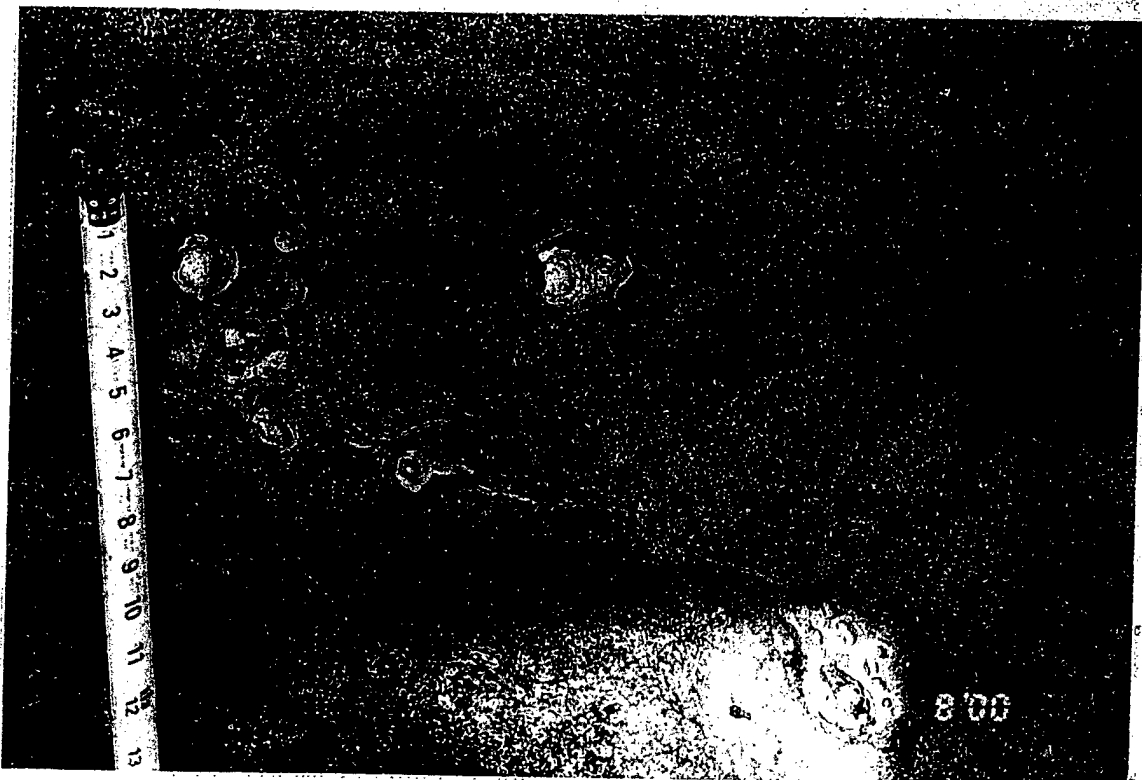


Lower
Granite
Dam

Gate 3
Skin plate pitting apparently
associated with scratches.

10/08/00

3-33

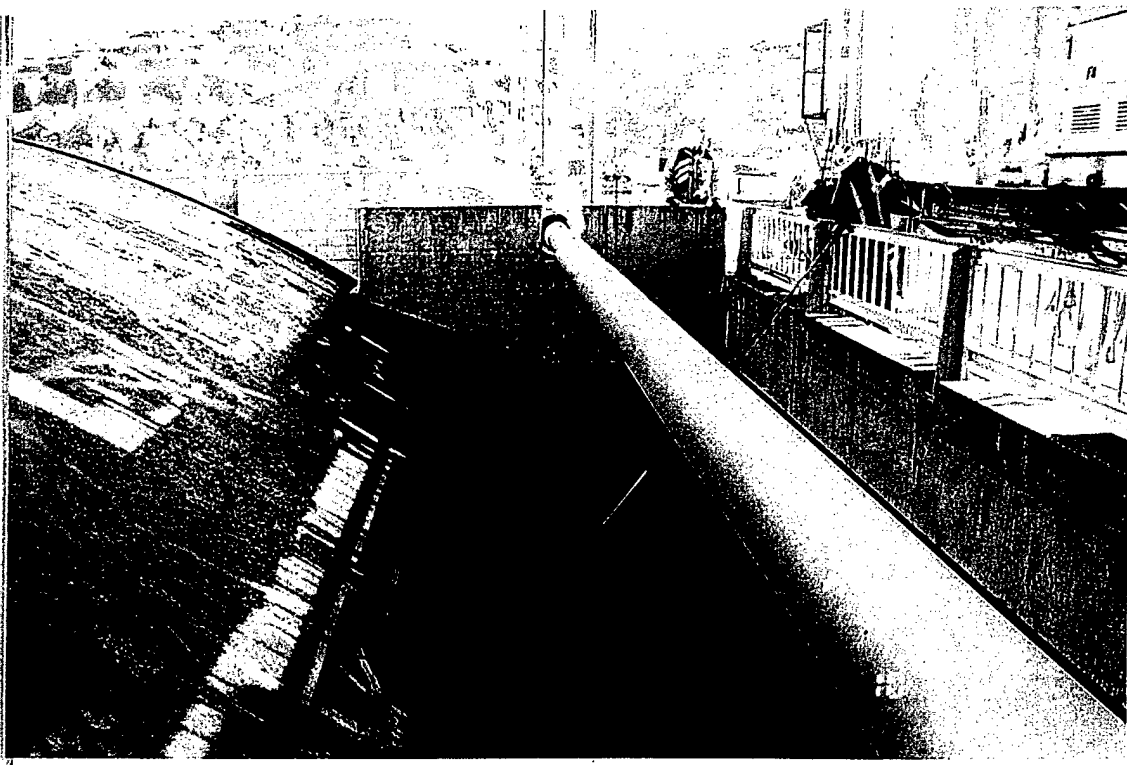


Lower
Granite
Dam

Gate 3
Skin plate pitting apparently
associated with scratches.

10/08/00

3-34



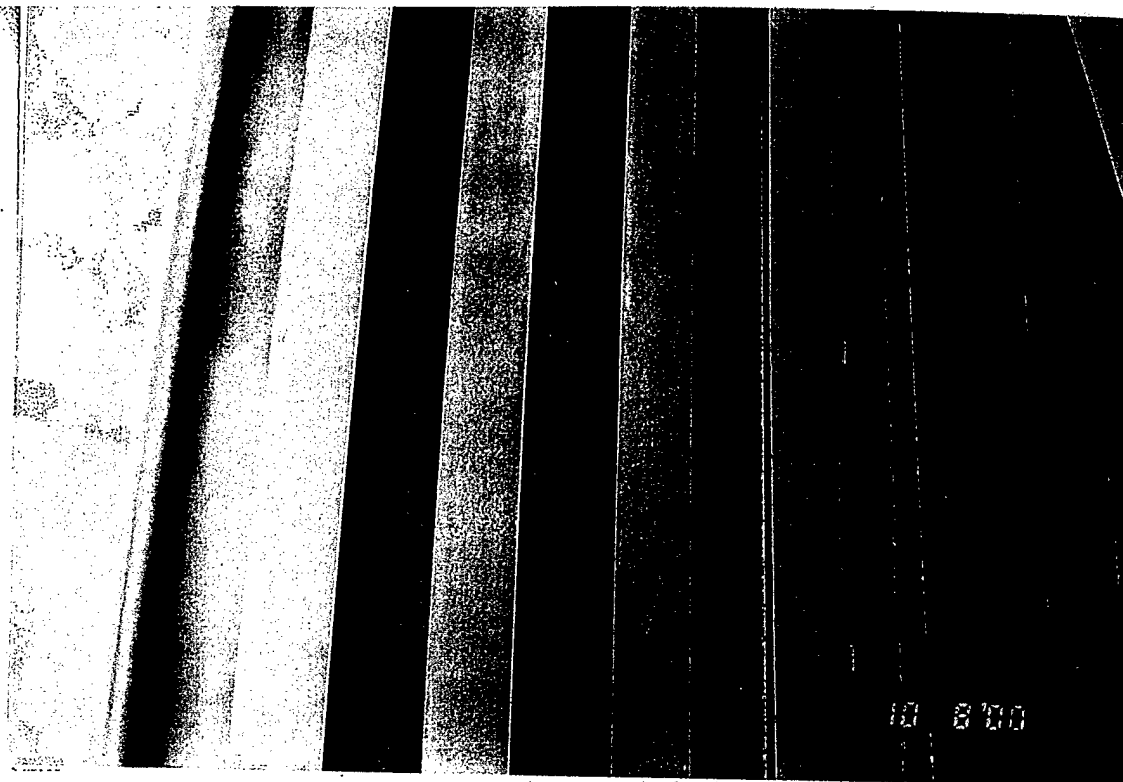
Lower
Granite
Dam

10/08/00

3-35

Gate 3

Waterblasting upstream surface of
skin plate.



Lower
Granite
Dam

10/08/00

4-1

Gate 4

Paint blister and apparent skin plate leak approximately 7' from left side of gate and 6' above 1/2" to 3/8" skin plate transition. Photo taken after waterblasting of upstream side.



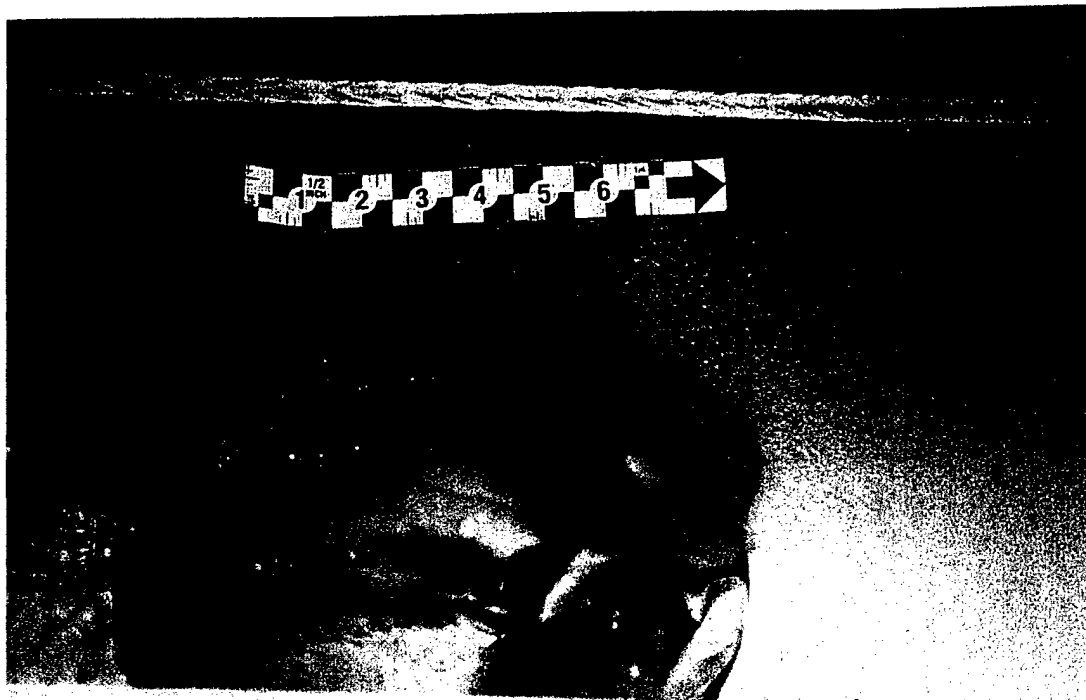
Lower
Granite
Dam

10/08/00

4-2

Gate 4

Paint blister and apparent skin plate leak approximately 7' from left side of gate and 6' above 1/2" to 3/8" skin plate transition. Photo taken after waterblasting of upstream side.

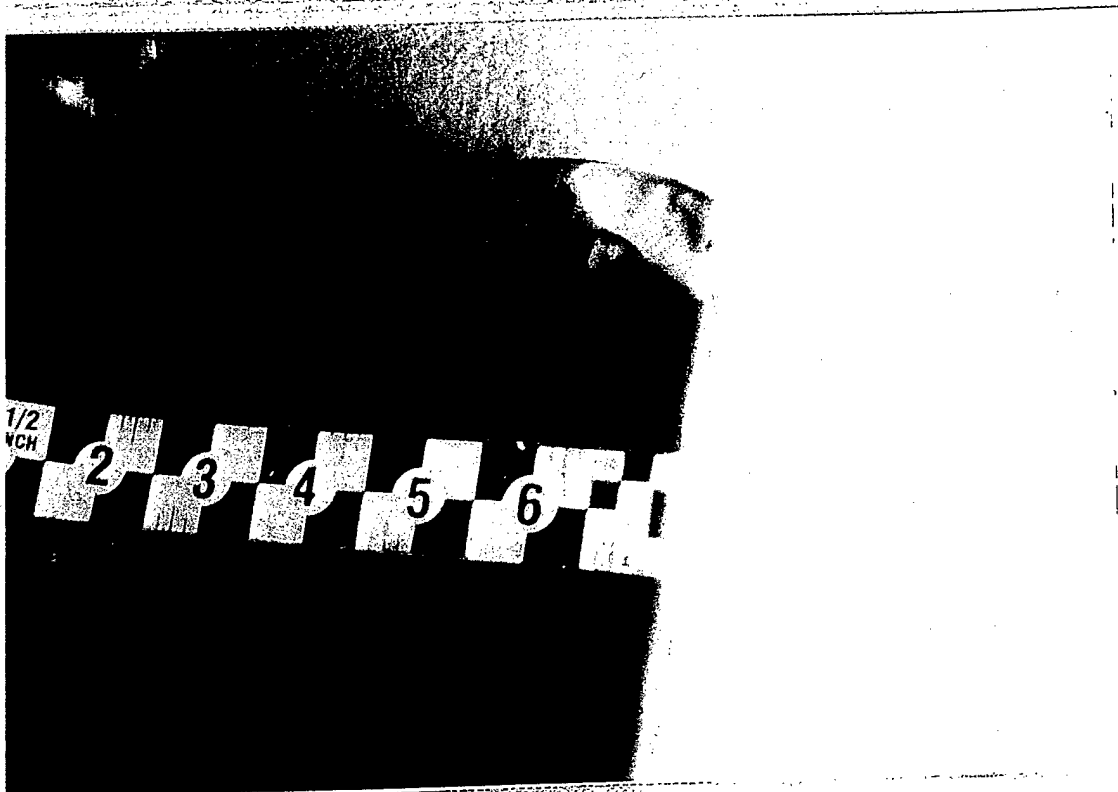


Lower
Granite
Dam

Gate 4
Close-up of paint blister / skin plate
leak.

10/08/00

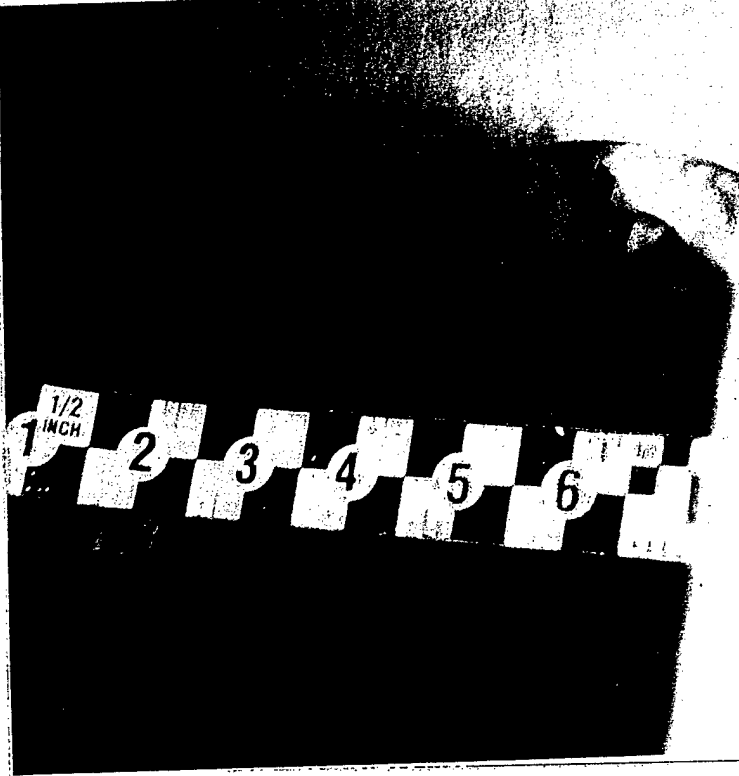
4-3



Lower
Granite
Dam

Gate 4
Skin plate leak after removal of paint
blister.

10/08/00

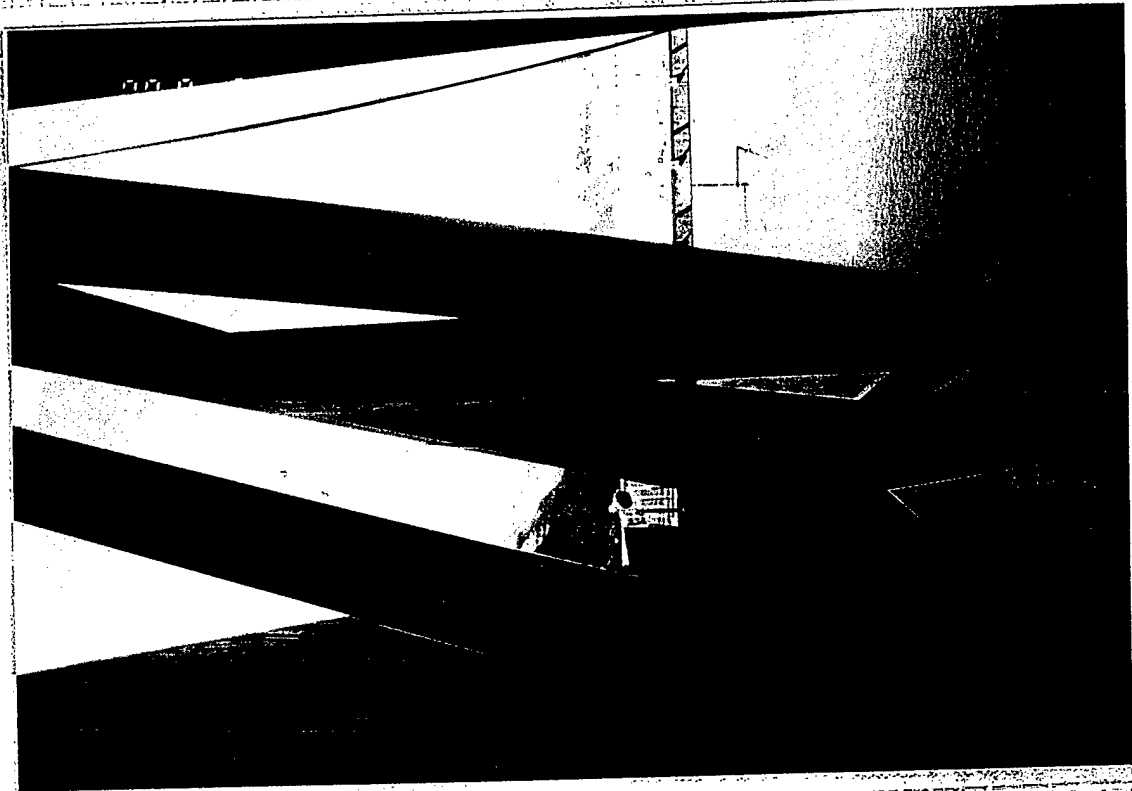


Lower
Granite
Dam

10/08/00

4-5

Gate 4
Skin plate leak after removal of paint
blister.



Lower
Granite
Dam

10/08/00

4-6

Gate 4
Left side frame, along outside of
frame looking downstream, typical.
Note: Skin plate leak landing on
middle radial strut.



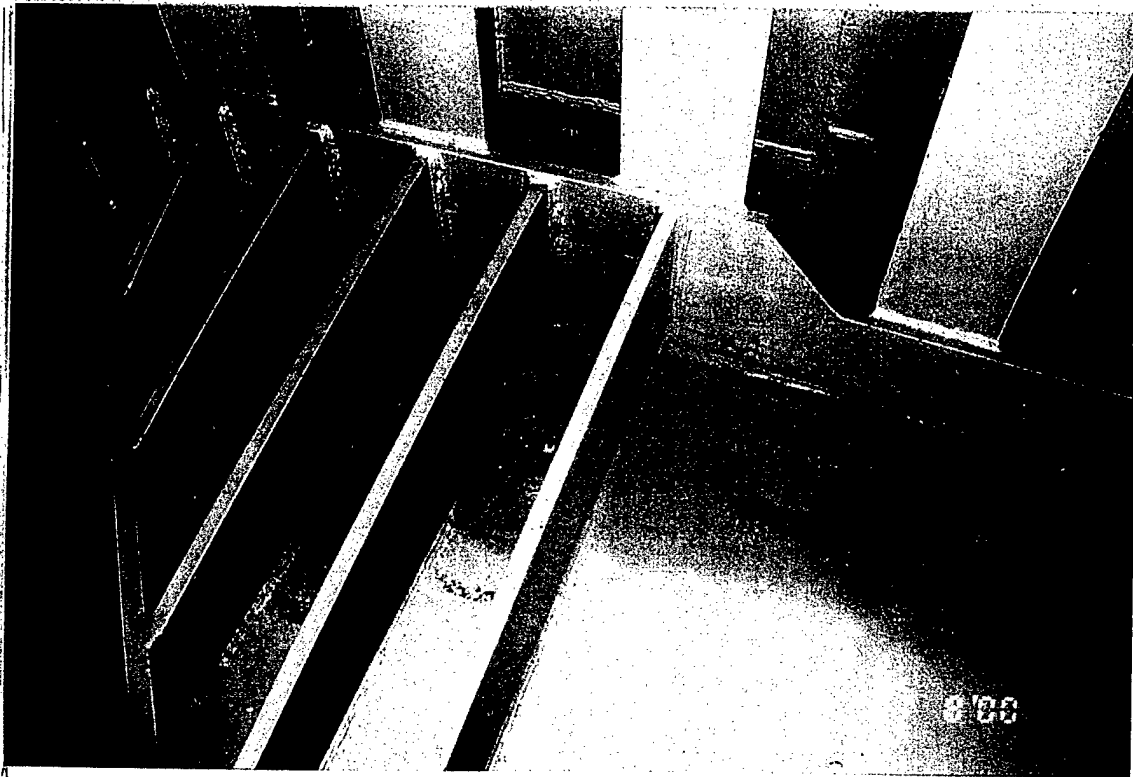
Lower
Granite
Dam

10/08/00

4-7

Gate 4

Skin plate leak after removal of paint
blister.



Lower
Granite
Dam

10/08/00

4-8

Gate 4

Right end of bottom horiz. girder.
Evidence of standing water, no
drainage between multiple stiffeners.
Horiz. girder to skin plate stiffeners,
debris and no drainage



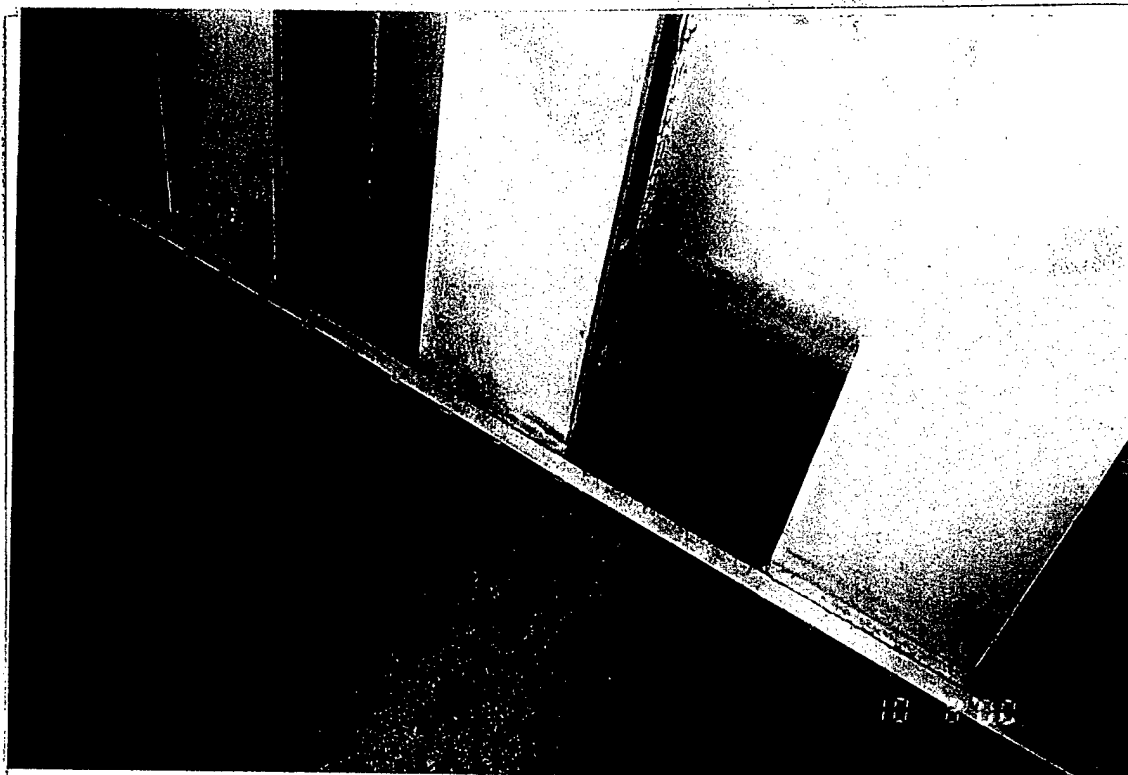
Lower
Granite
Dam

Gate 4

Bottom of upstream end of bottom
radial strut, drain hole, typical.

10/08/00

4-9



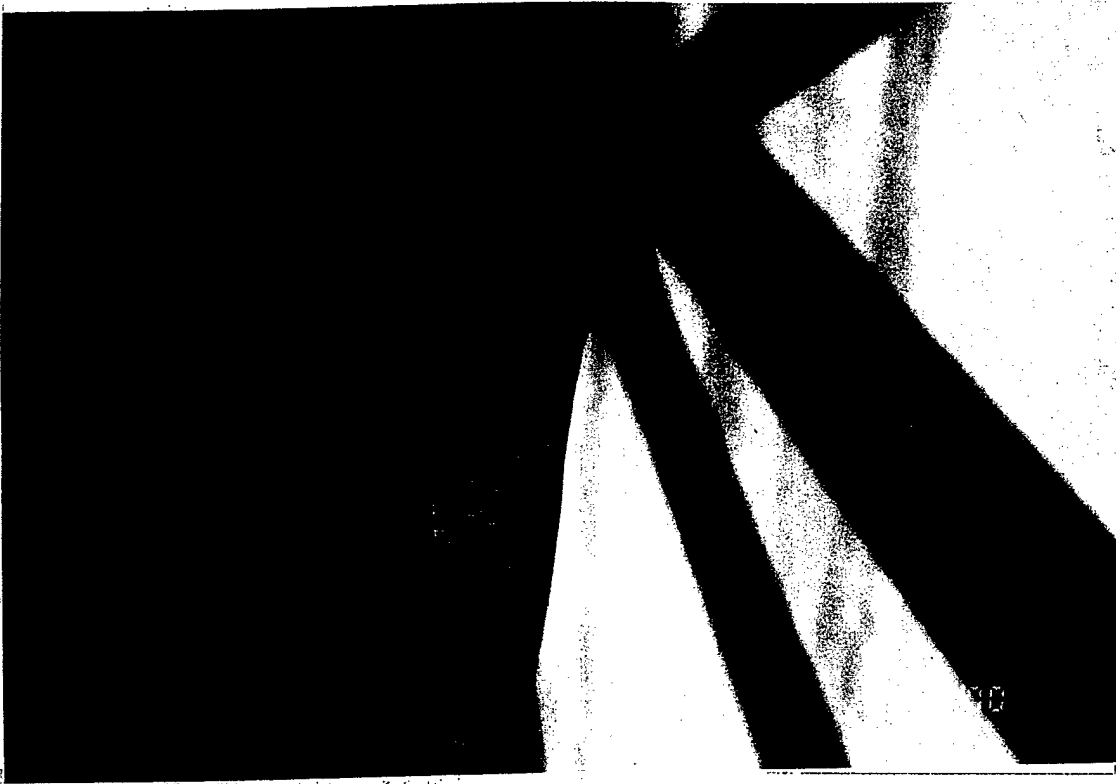
Lower
Granite
Dam

Gate 4

Bottom seal closure plate looking
upstream. Standing water between
closure plate, purlin webs and
skinplate. Typical.

10/08/00

4-10



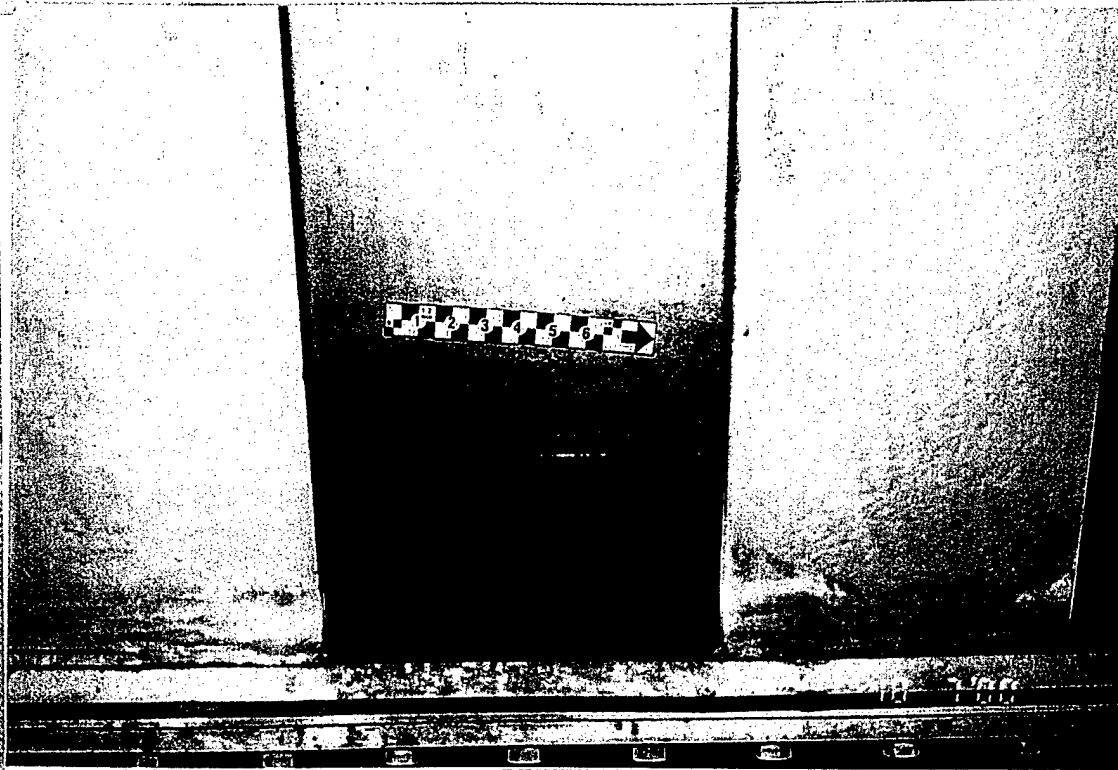
Lower
Granite
Dam

10/08/00

4-11

Gate 4

Right frame, Brace F. Small deformation, approx. 1/8" on outside flange.



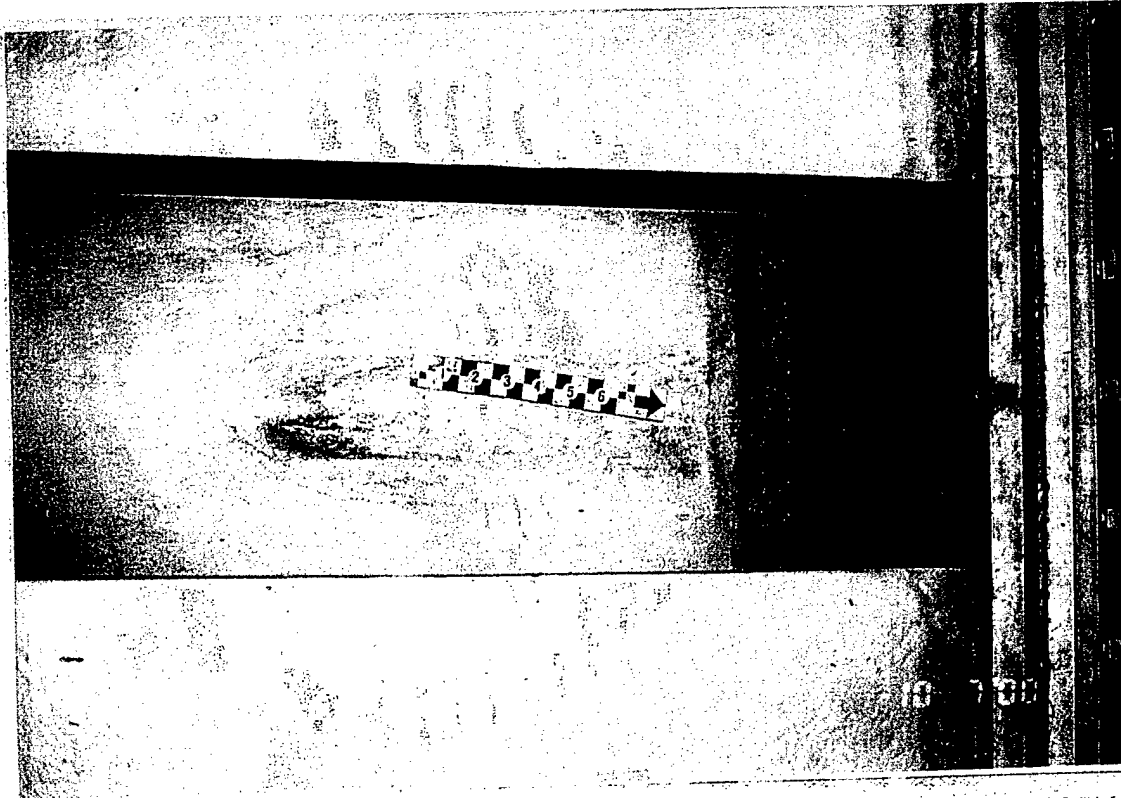
Lower
Granite
Dam

10/07/00

4-12

Gate 4

Bottom seal closure plate looking upstream. Standing water between closure plate, purlin webs and skinplate. Typical.

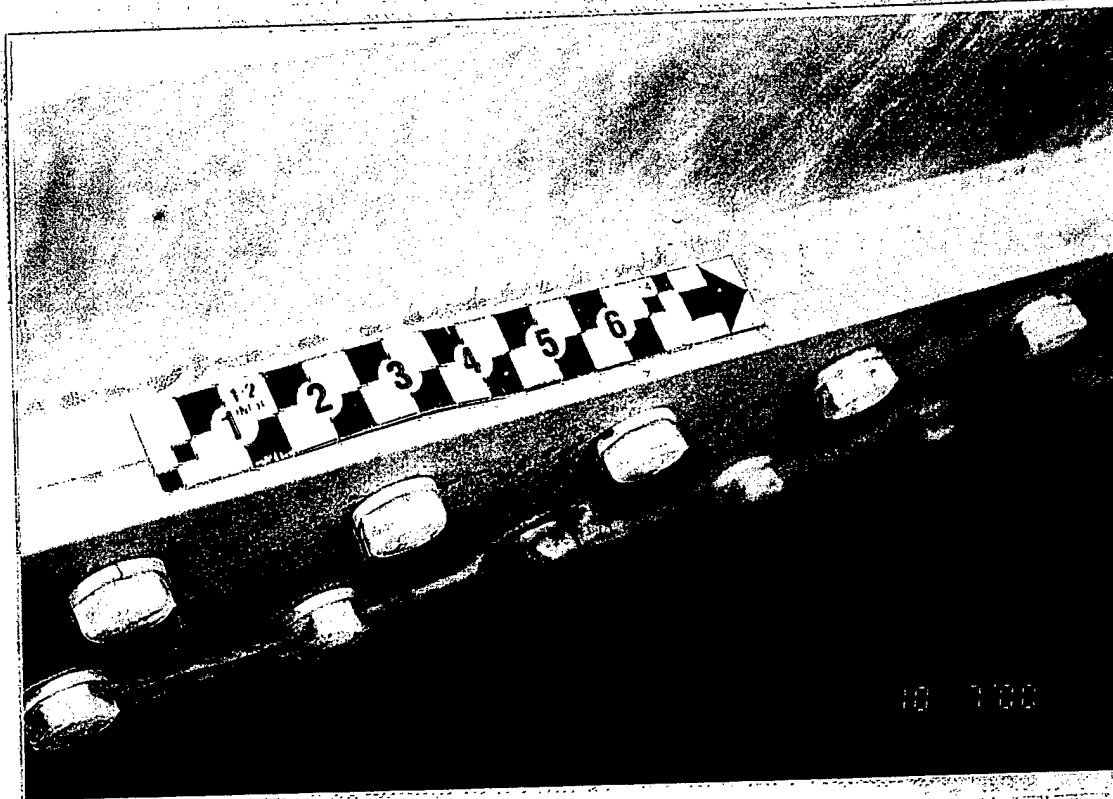


Lower
Granite
Dam

10/07/00

4-13

Gate 4
Bottom seal closure plate looking
upstream. Standing water between
closure plate, purlin webs and
skinplate. Typical.

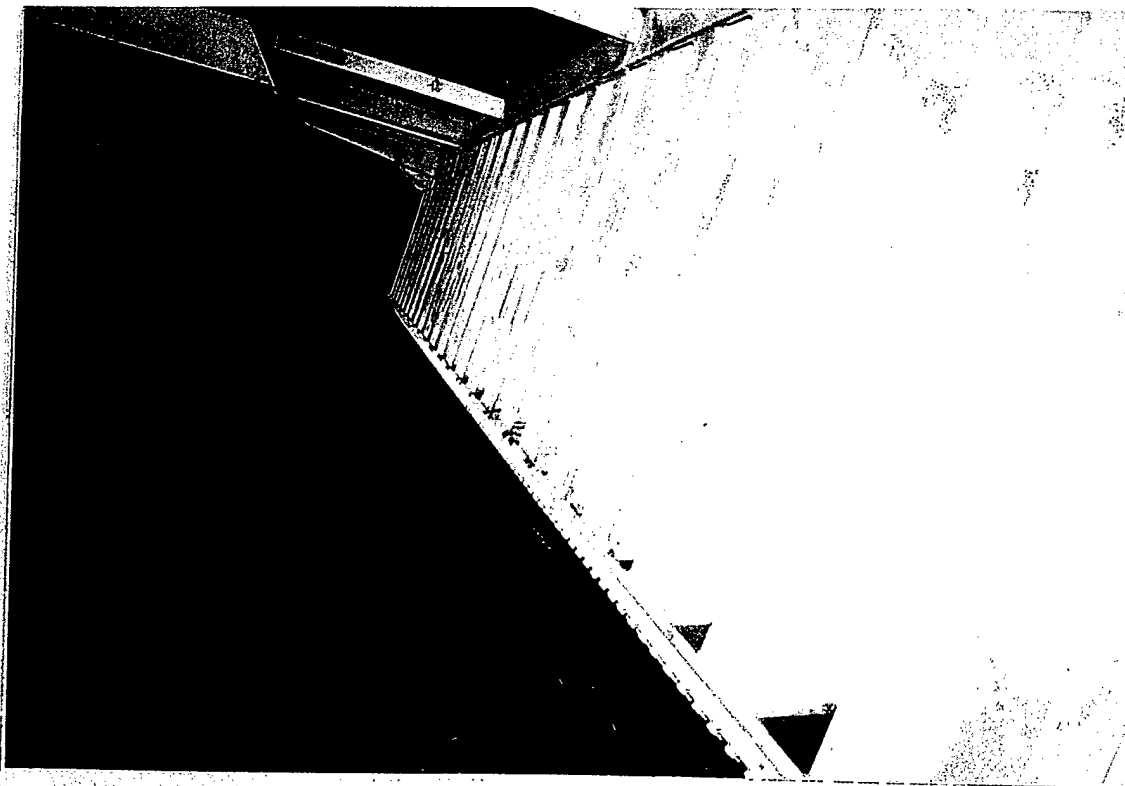


Lower
Granite
Dam

10/07/00

4-14

Gate 4
Bottom seal and keeper plate,
looking upstream, typical.



Lower
Granite
Dam

10/07/00

4-15

Gate 4

Bottom of downstream side of gate,
typical.



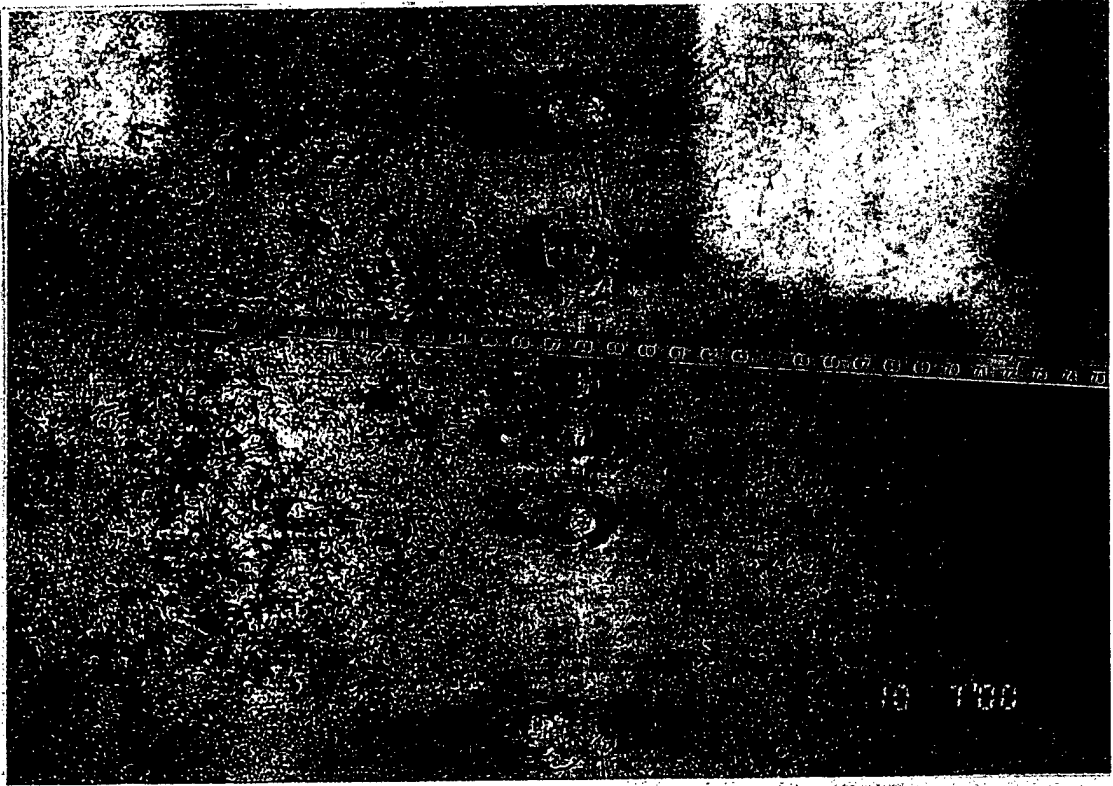
Lower
Granite
Dam

10/07/00

4-16

Gate 4

Waterblasting of skinplate.
Distribution of pitting, typical.



Lower
Granite
Dam

Gate 4
Skin plate pitting, typical.

10/07/00

4-17

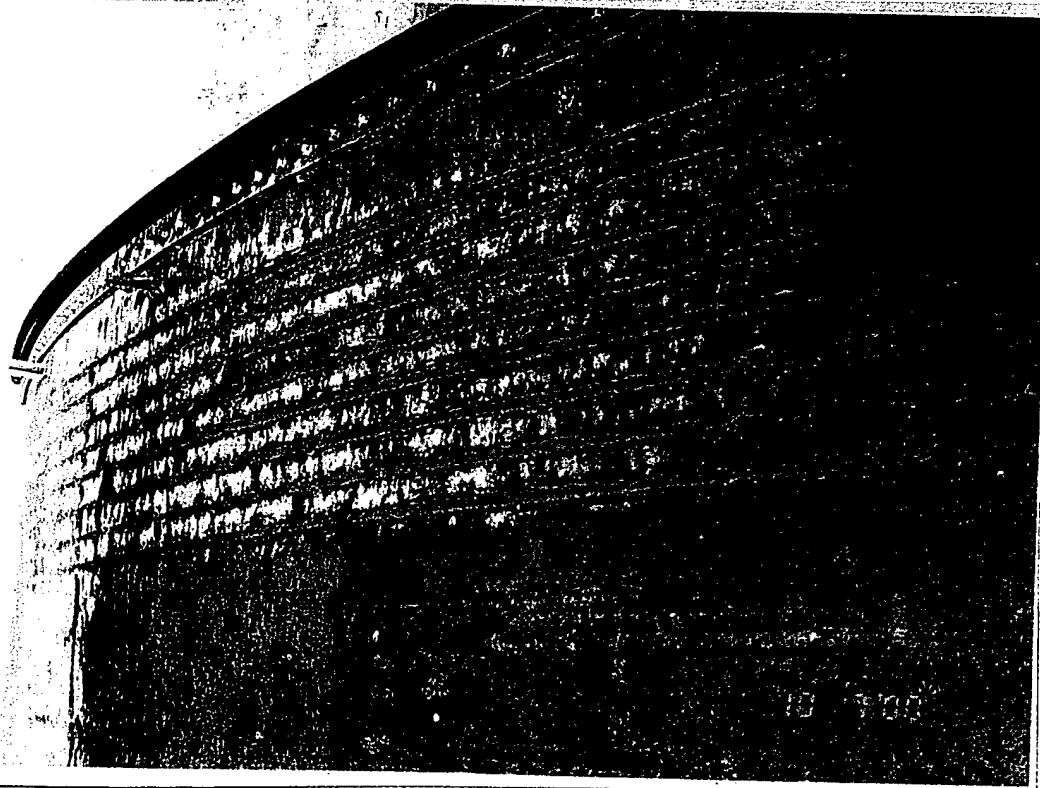


Lower
Granite
Dam

Gate 4
Skin plate pitting, typical.

10/07/00

4-18



Lower
Granite
Dam

10/07/00

4-19

Gate 4

Typical wear plate condition. Light
grooves due to cable wear, light to
moderate corrosion.



Lower
Granite
Dam

10/08/00

5-1

Gate 5

Right frame, upstream end of top
radial strut. Delaminated paint and
light corrosion on web.



Lower
Granite
Dam

10/08/00

5-2

Gate 5

Side seal leak, right side of gate.



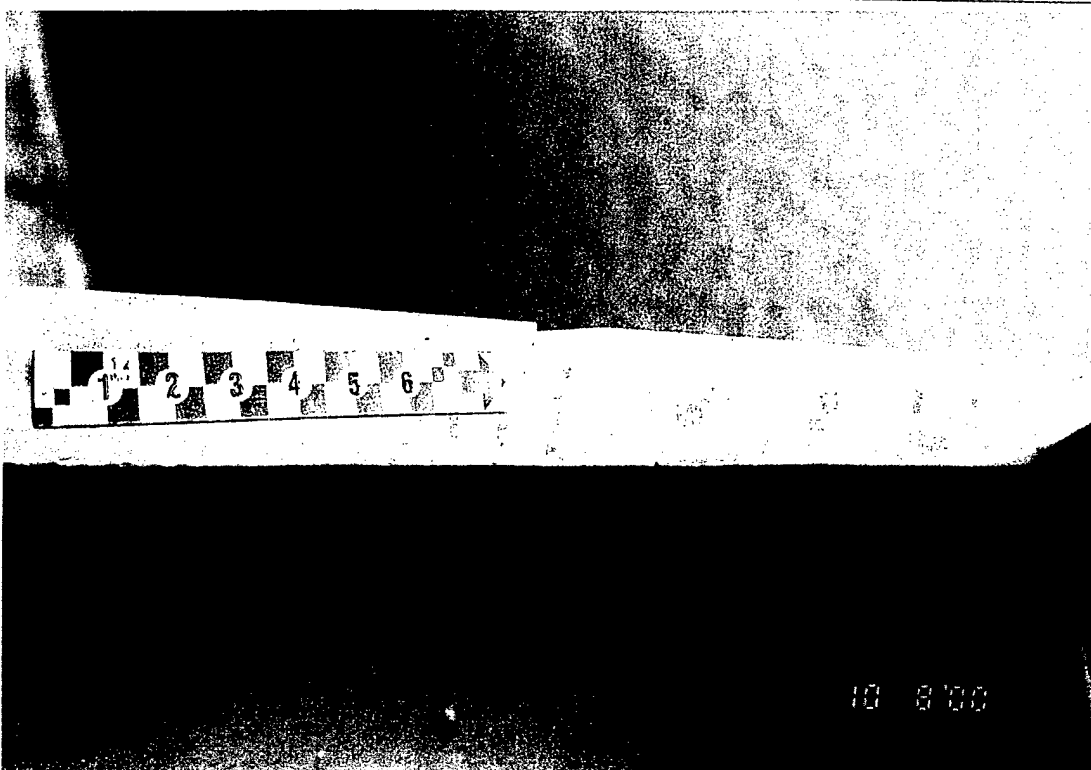
Lower
Granite
Dam

10/08/00

5-3

Gate 5

Right end of middle horizontal girder.
Light corrosion due to side seal leak.



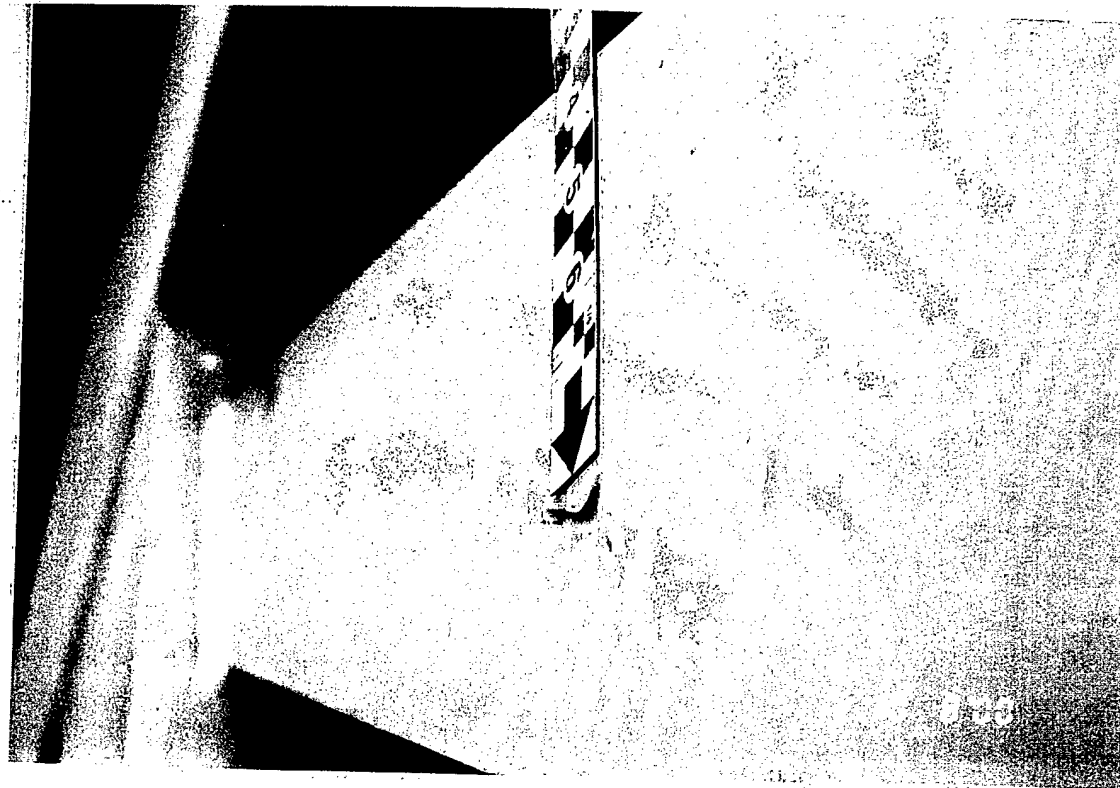
Lower
Granite
Dam

10/08/00

5-4

Gate 5

Right frame, middle radial strut,
between braces G and E. Small
deformation on top, inside flange.



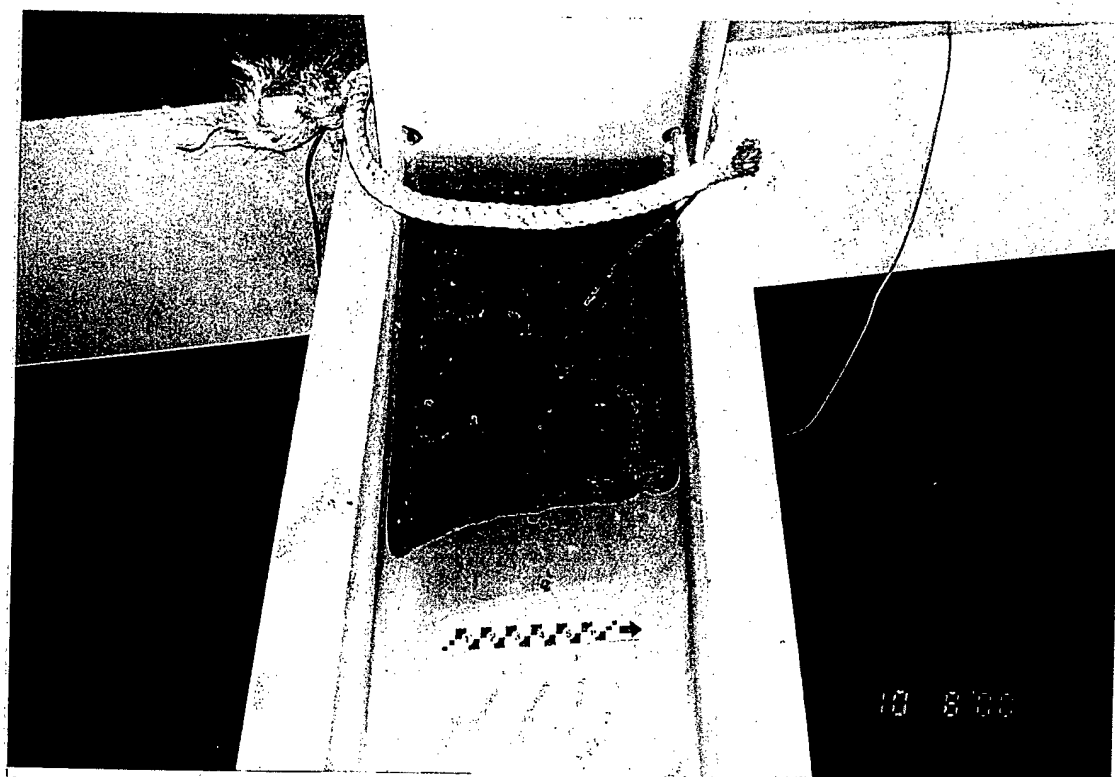
Lower
Granite
Dam

10/08/00

5-5

Gate 5

Right frame, Brace H. Small
deformation on inside flange.



Lower
Granite
Dam

10/08/00

5-6

Gate 5

Right frame, upstream end of bottom
radial strut. Ponding due to
inadequate drainage.



Lower
Granite
Dam

10/08/00

5-7

Gate 5

Right end of bottom horizontal girder.
Standing water, no drainage between
multiple stiffeners. Horizontal girder
to skin plate stiffeners, standing
water, debris and no drainage



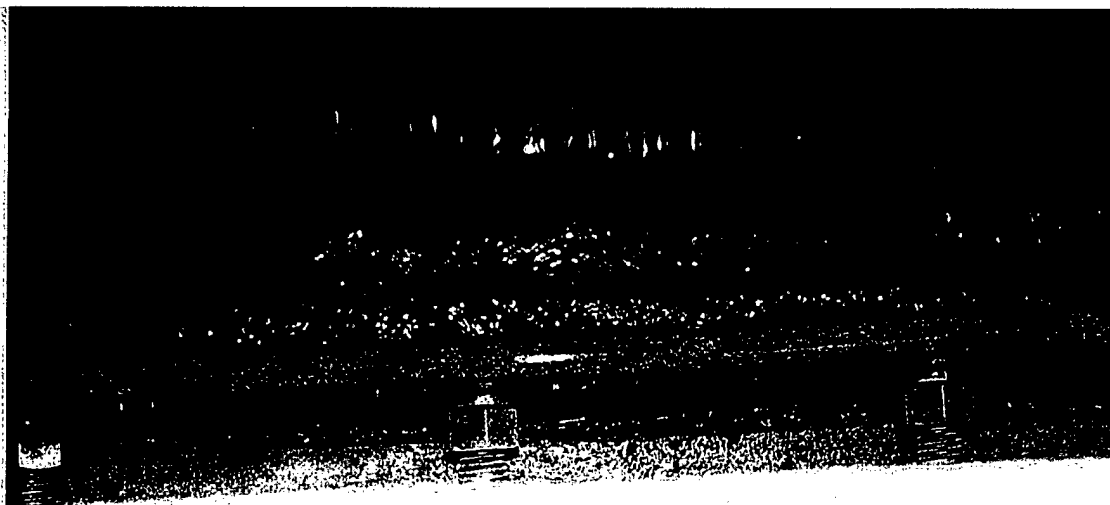
Lower
Granite
Dam

10/08/00

5-8

Gate 5

Left end of bottom horizontal girder.
Standing water, inadequate drainage
between stiffeners.



Lower
Granite
Dam

10/08/00

5-9

Gate 5
Side seal, typical.

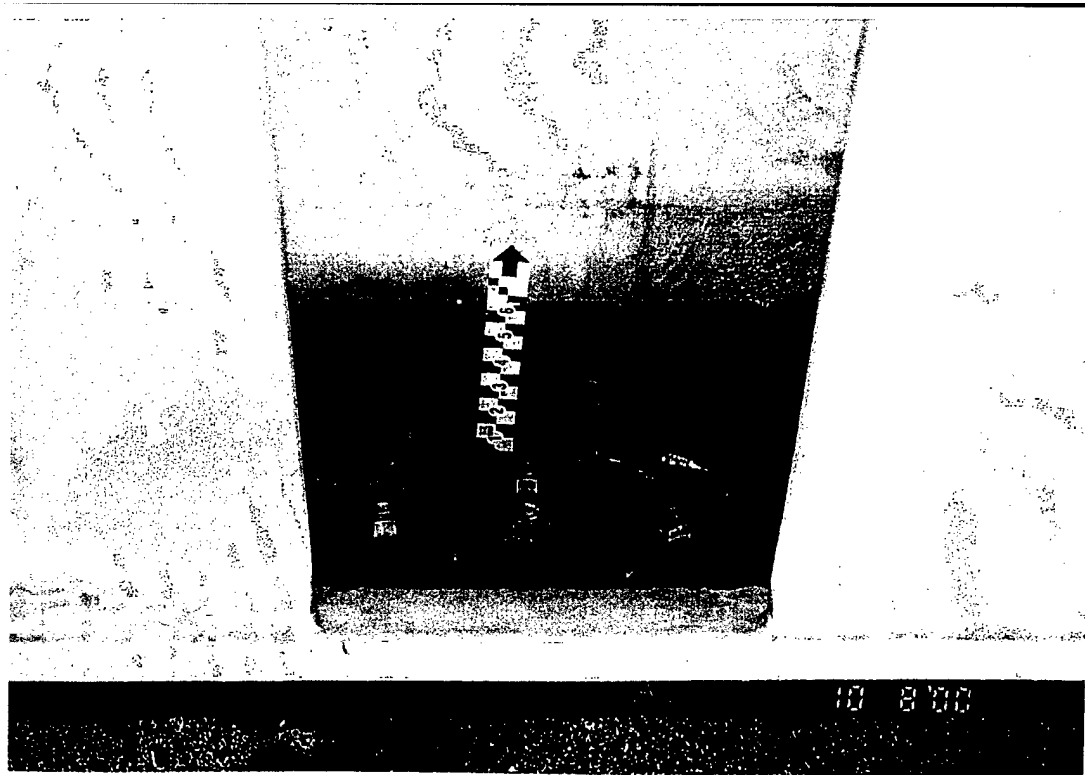


Lower
Granite
Dam

10/08/00

5-10

Gate 5
Bottom of gate at spillway, typical.



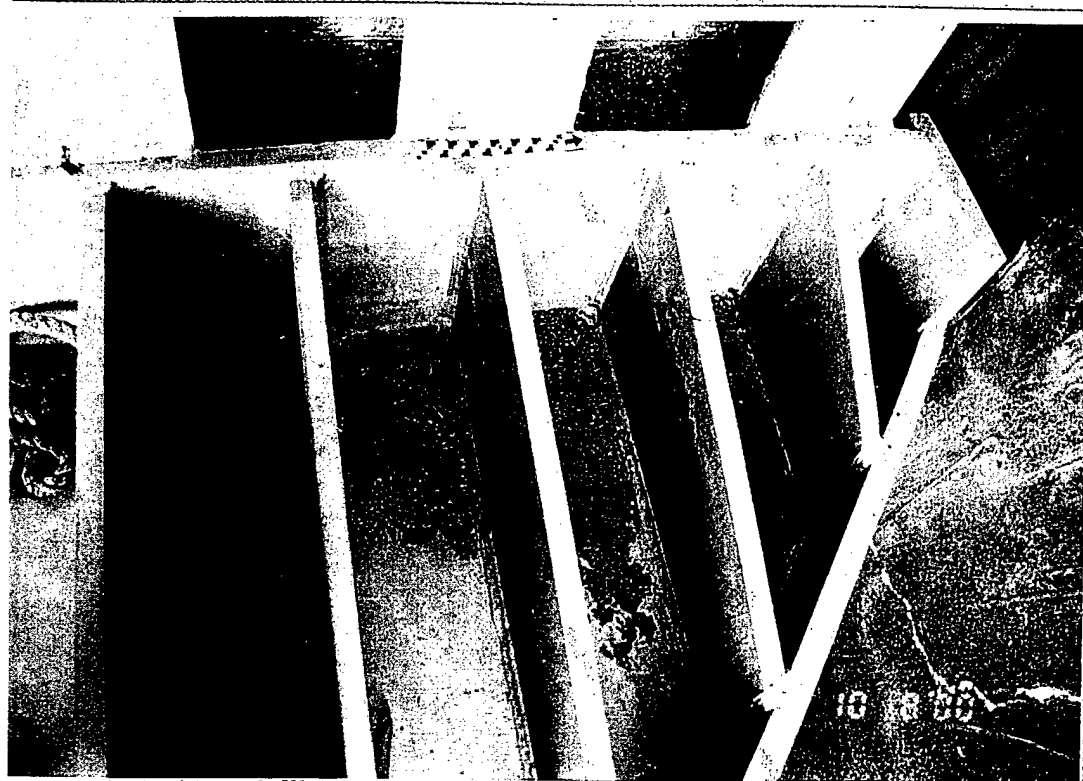
Lower
Granite
Dam

10/08/00

5-11

Gate 5

Bottom seal closure plate looking upstream. Standing water between closure plate, purlin webs and skinplate. Typical.



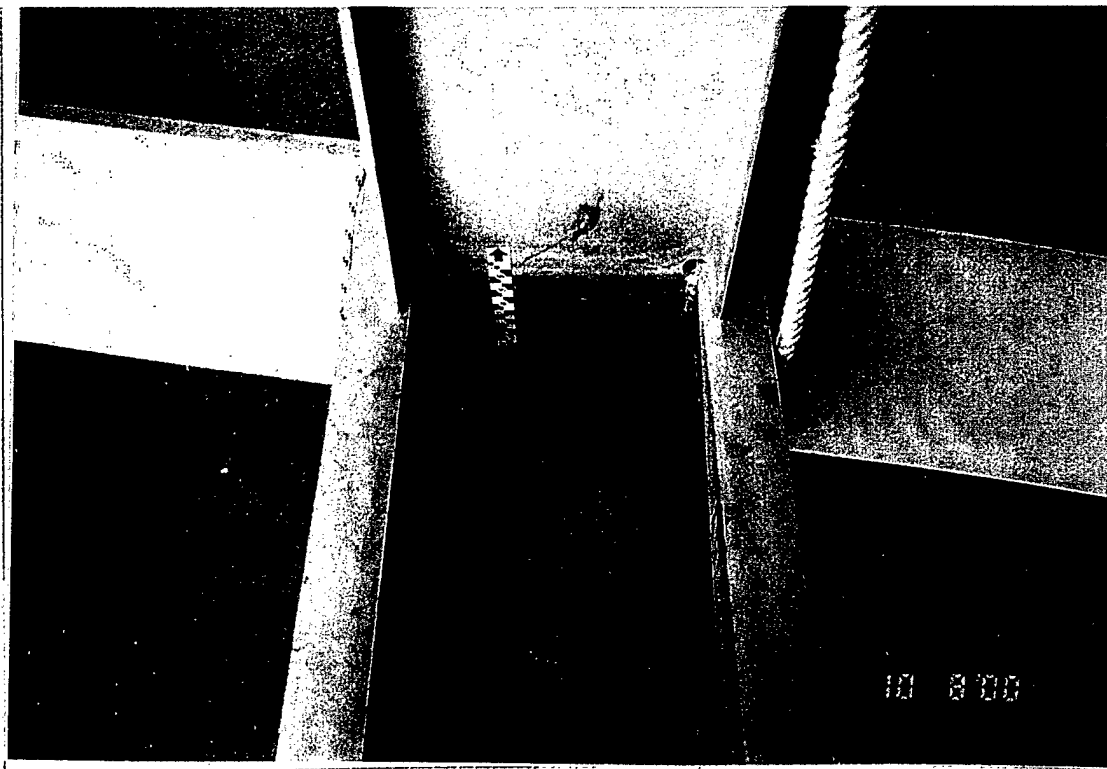
Lower
Granite
Dam

10/08/00

5-12

Gate 5

Left end of bottom horizontal girder. Evidence of standing water, no drainage between multiple stiffeners.



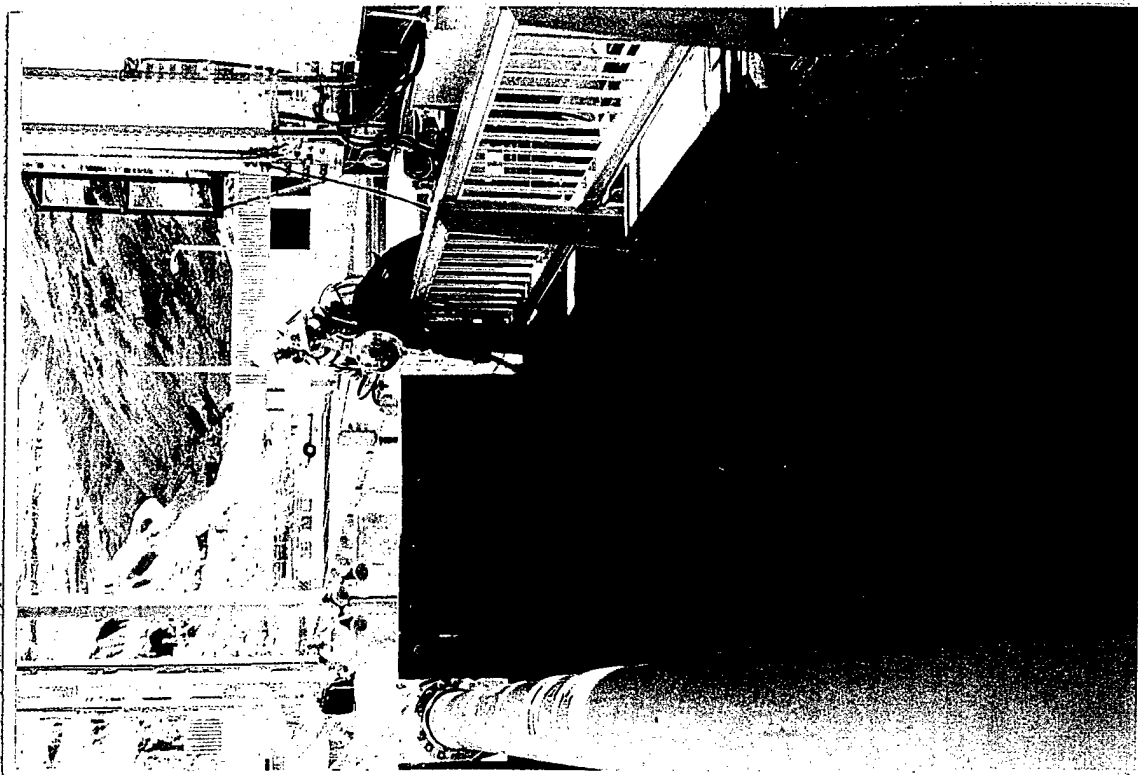
Lower
Granite
Dam

10/08/00

5-13

Gate 5

Left frame, upstream end of bottom
radial strut. Ponding due to
inadequate drainage.



Lower
Granite
Dam

10/06/00

5-14

Gate 5

Waterblasting upstream surface of
skin plate.

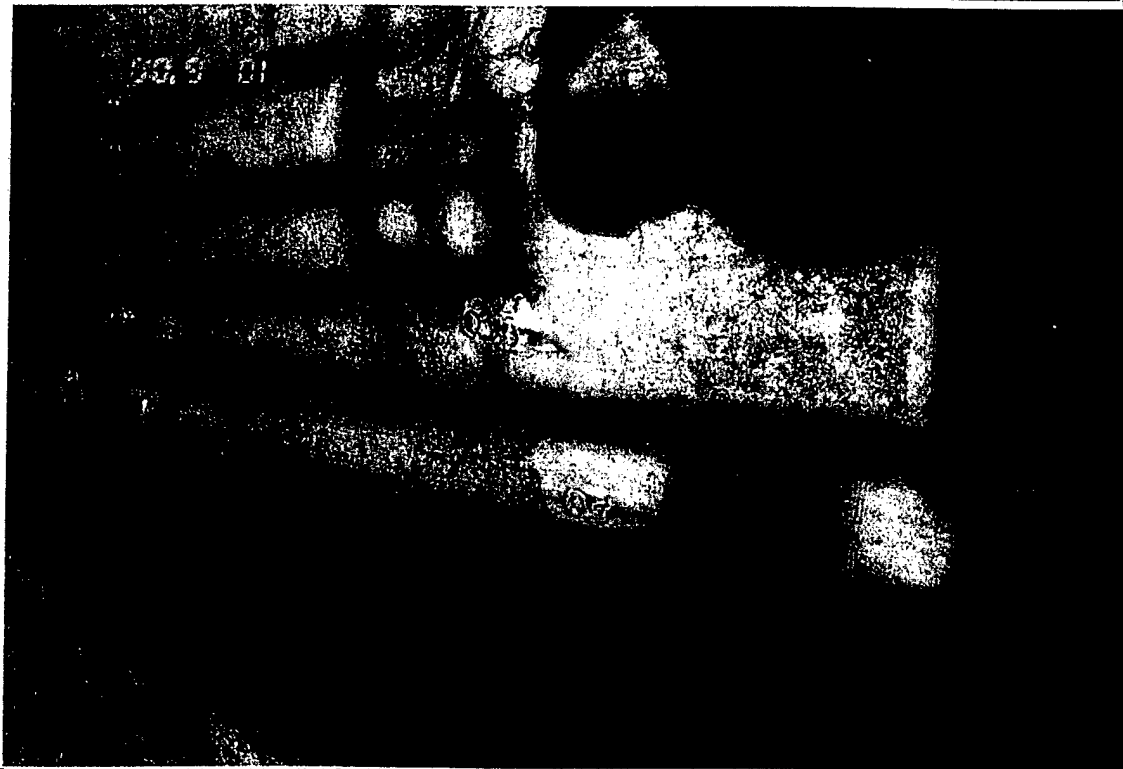


Lower
Granite
Dam

10/06/00

5-15

Gate 5
Skin plate pitting, typical.

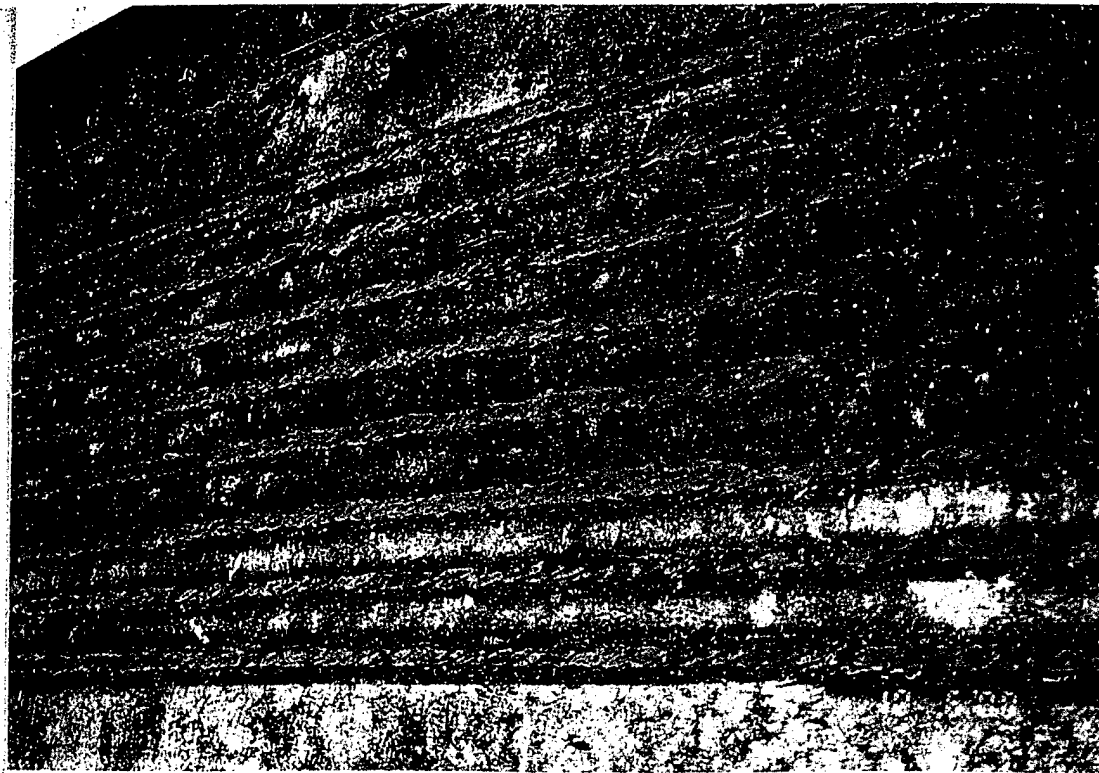


Lower
Granite
Dam

10/06/00

5-16

Gate 5
Skin plate pitting, typical.



Lower
Granite
Dam

10/06/00

5-17

Gate 5

Typical wear plate condition. Light grooves due to cable wear, light to moderate corrosion.



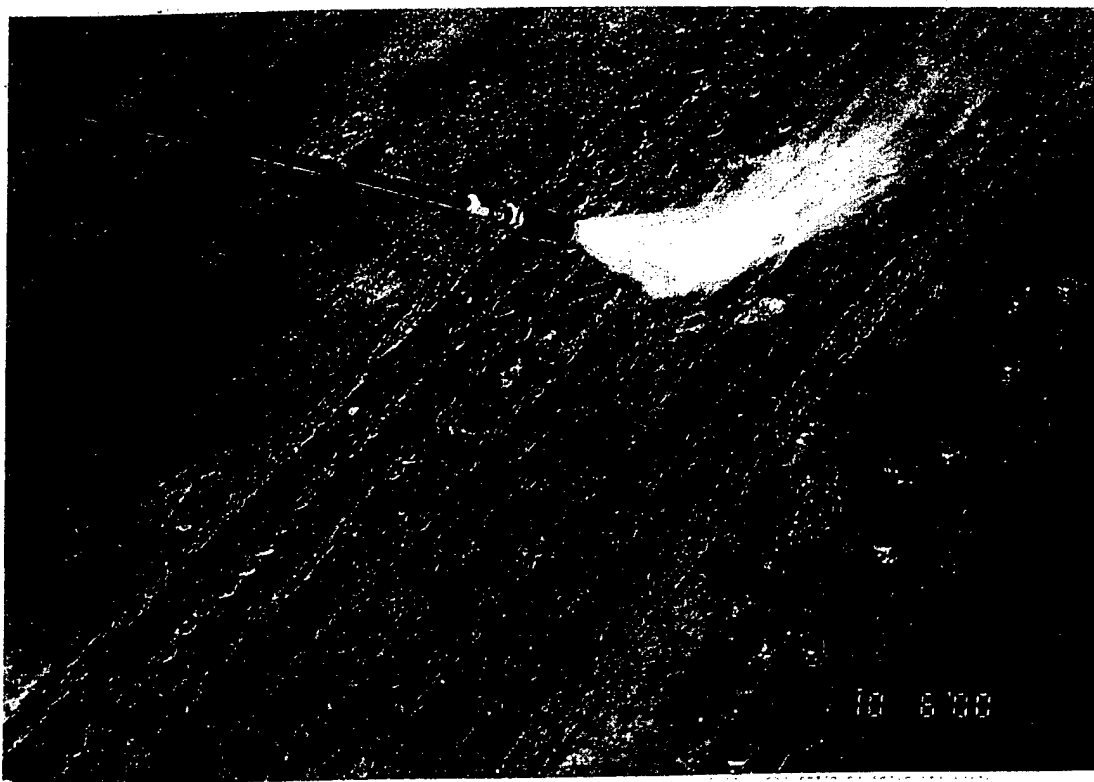
Lower
Granite
Dam

10/06/00

5-18

Gate 5

Skin plate pitting apparently associated with scratches in protective coating.



10 8'00

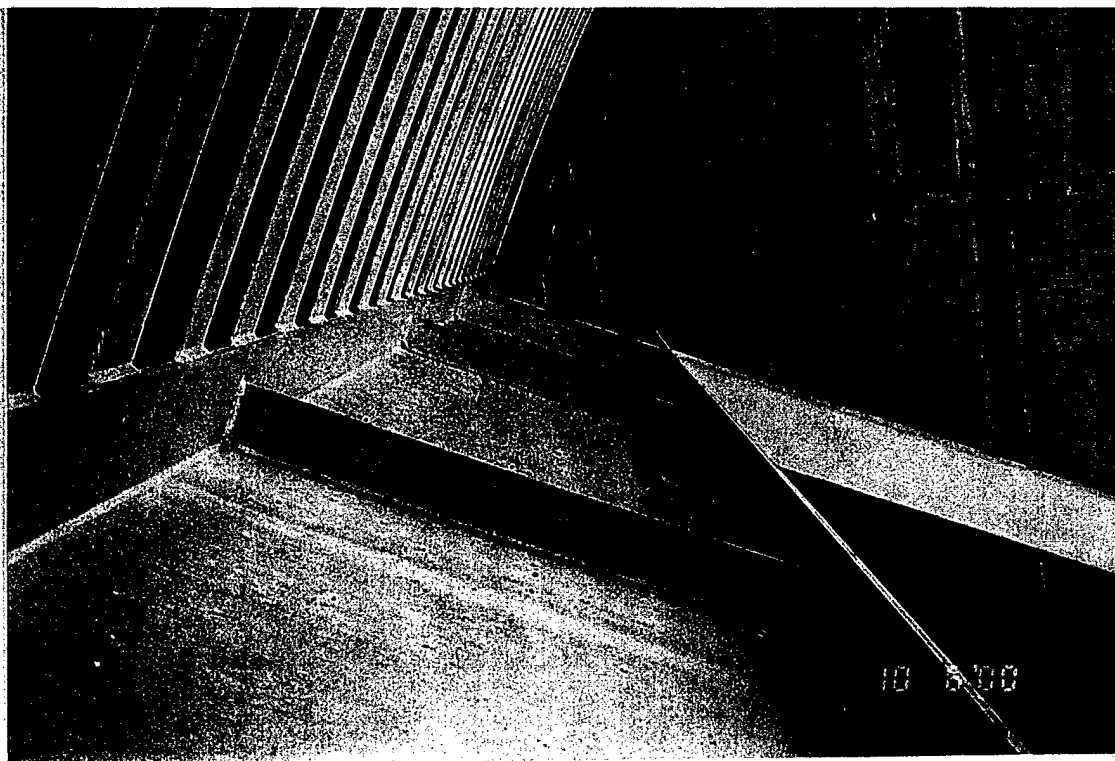
Lower
Granite
Dam

10/06/00

5-19

Gate 5

Typical wear plate condition. Light
grooves due to cable wear, light to
moderate corrosion.

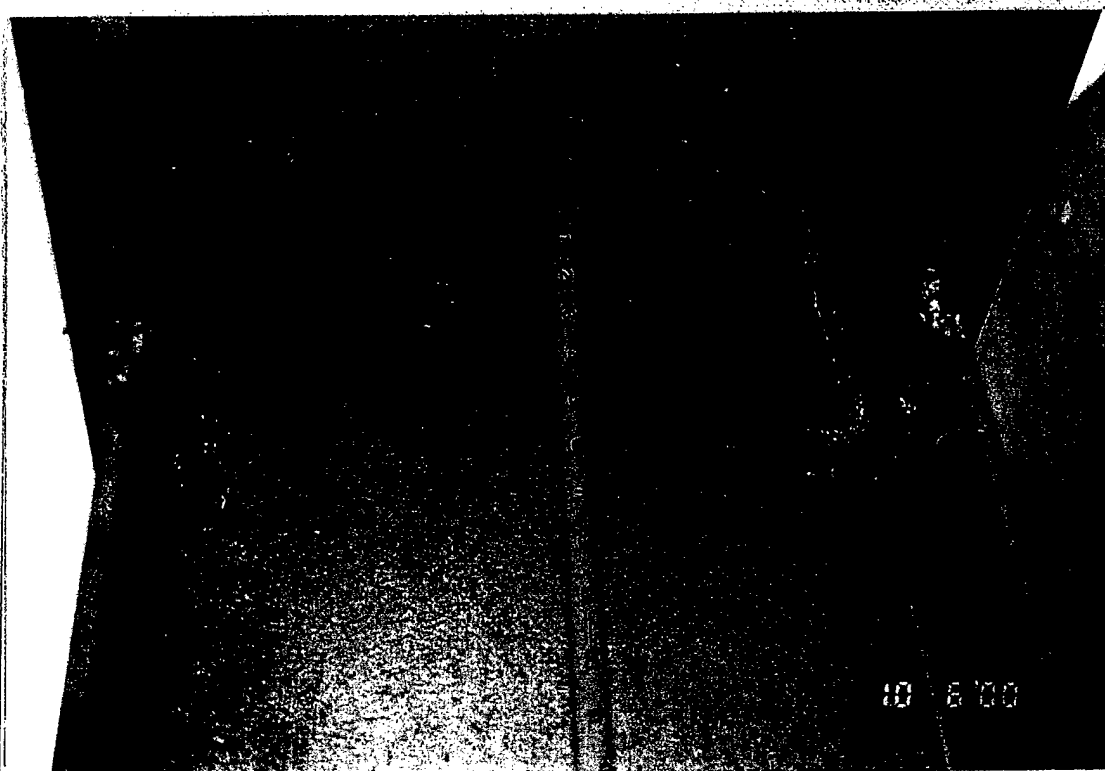


Lower
Granite
Dam

Gate 6
Top horizontal girder looking toward
left frame, typical

10/06/00

6-1

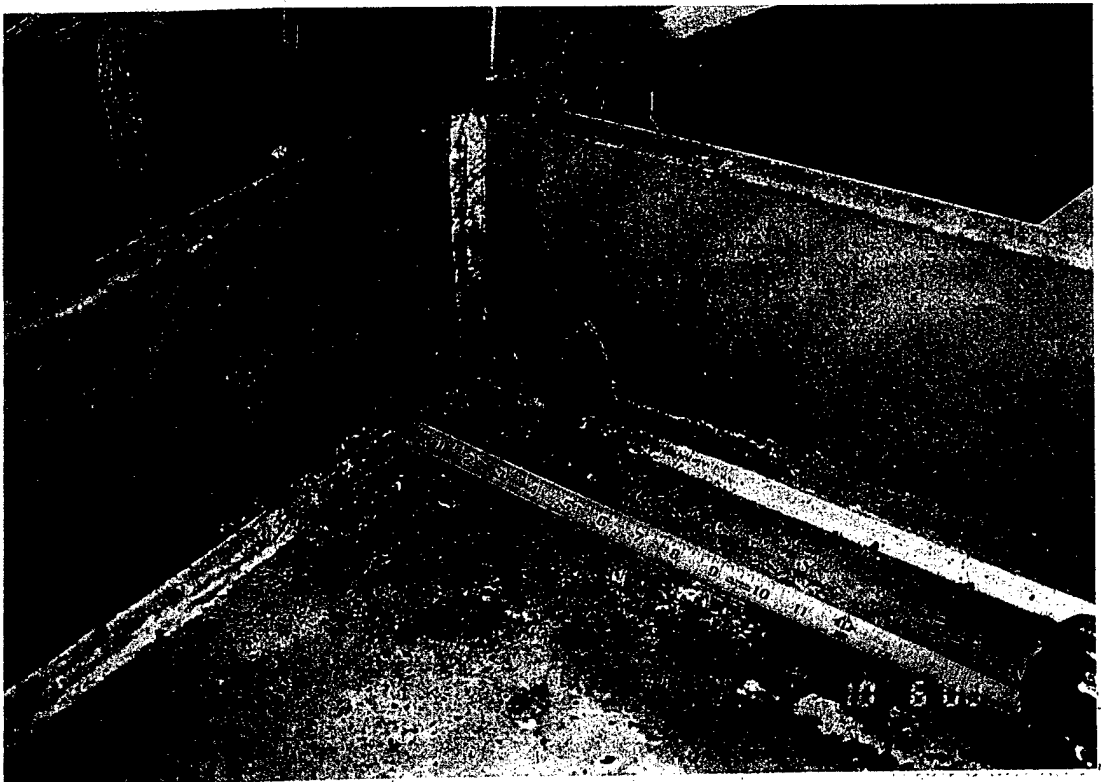


Lower
Granite
Dam

Gate 6
Right frame, Brace C. Coping in
brace at weld to top radial strut.

10/06/00

6-2



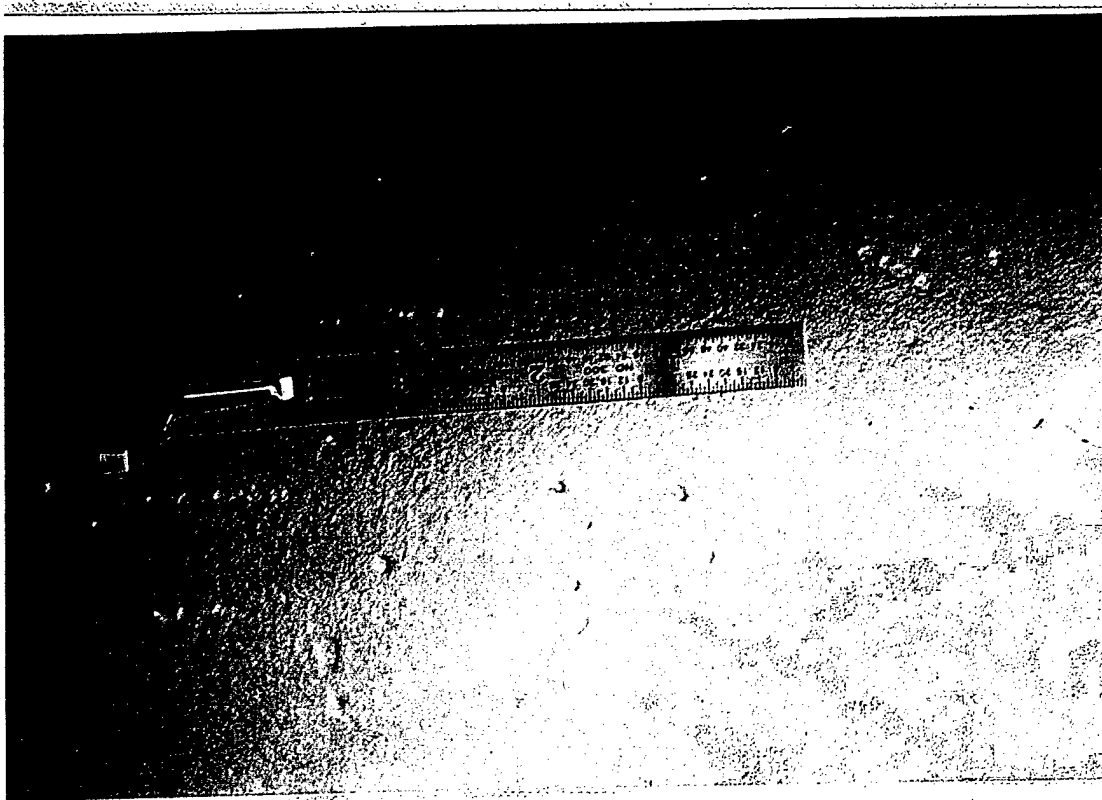
Lower
Granite
Dam

10/06/00

6-3

Gate 6

Middle horizontal girder, downstream
flange at connection to radial strut.
Light corrosion on girder flange.



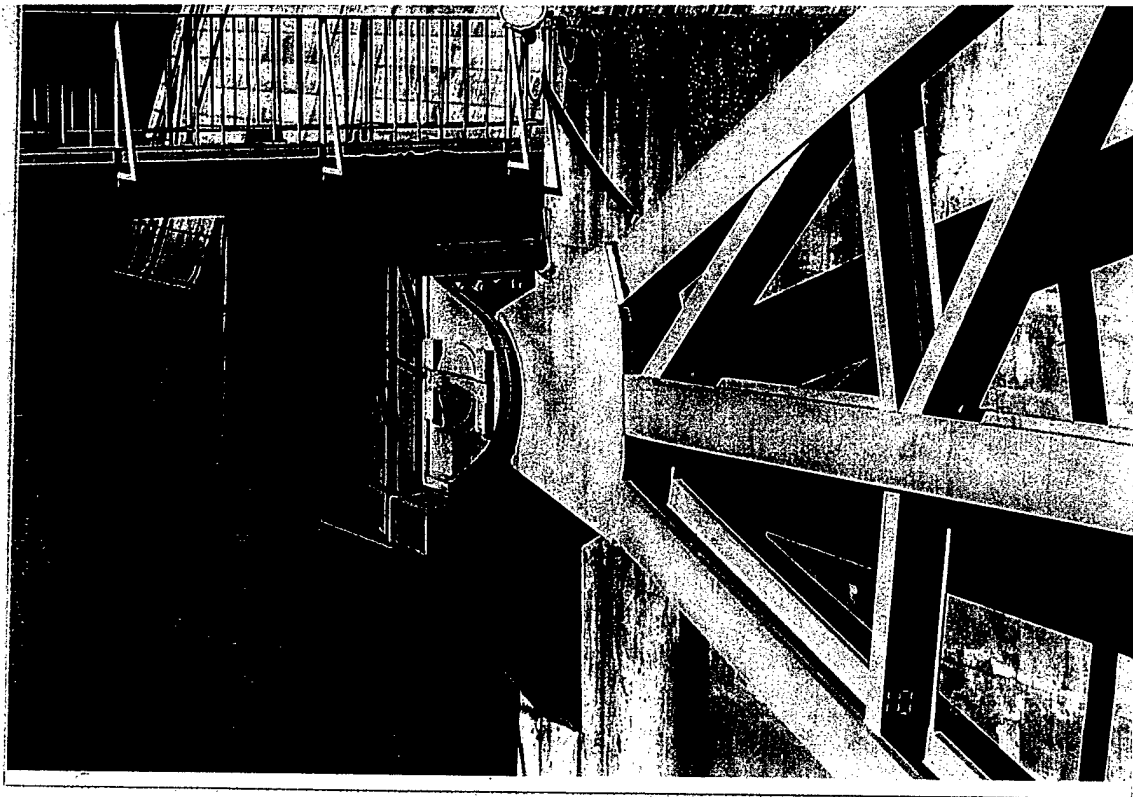
Lower
Granite
Dam

10/06/00

6-4

Gate 6

Downstream surface of skin plate,
approx 5' above middle horizontal
girder, near left frame. Small surface
pitting.

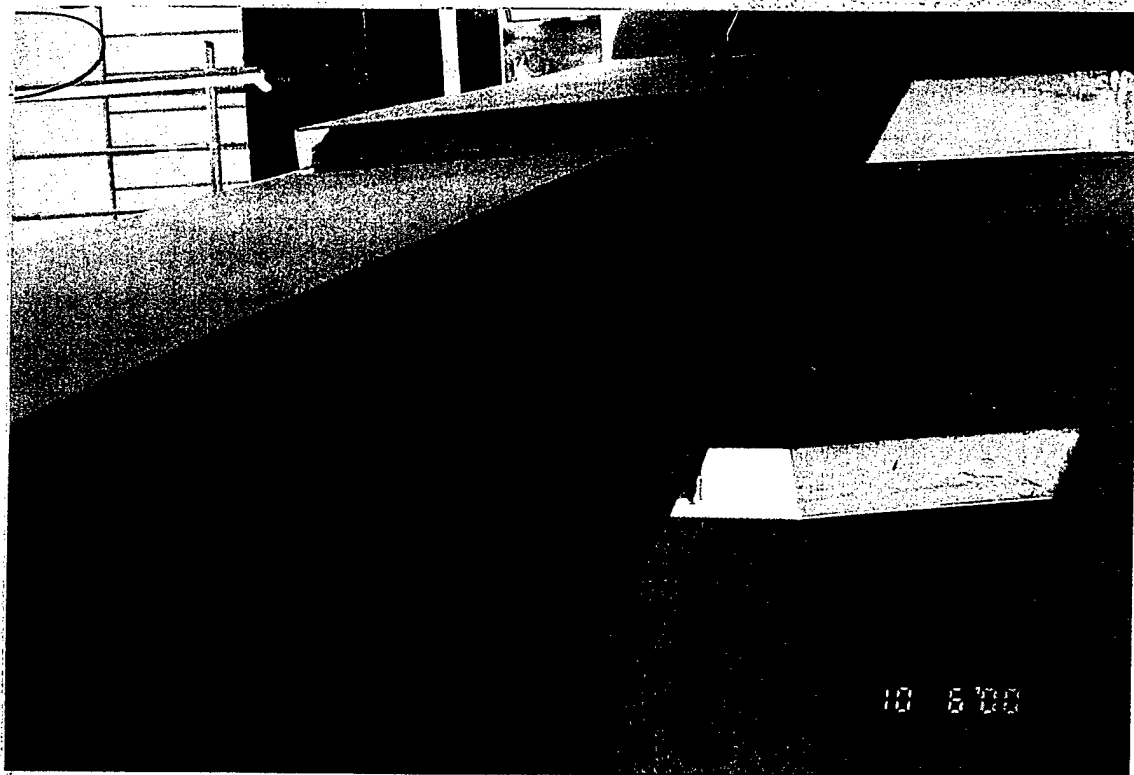


Lower
Granite
Dam

10/06/00

6-5

Gate 6
Right frame and trunnion, typical.



Lower
Granite
Dam

10/06/00

6-6

Gate 6
Left frame, inside trunnion closure
plate, typical.

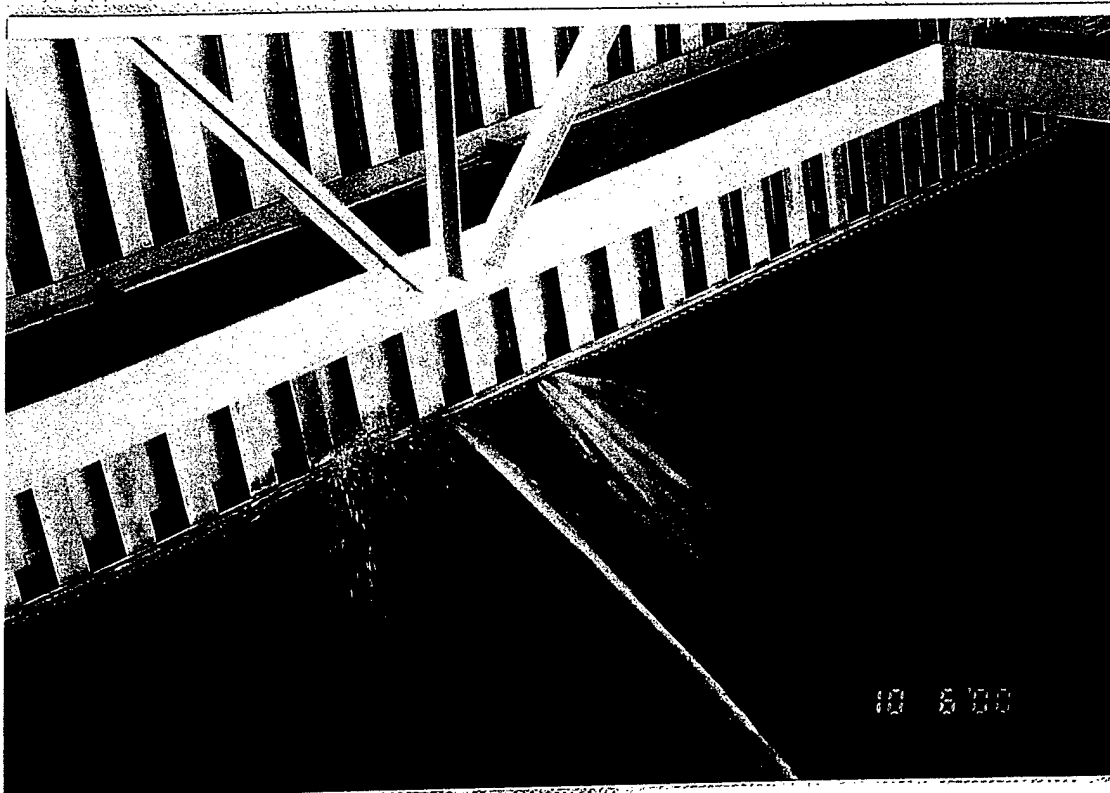


Lower
Granite
Dam

10/06/00

6-7

Gate 6
Outside of right trunnion and yoke.
Note: Lubrication lines.

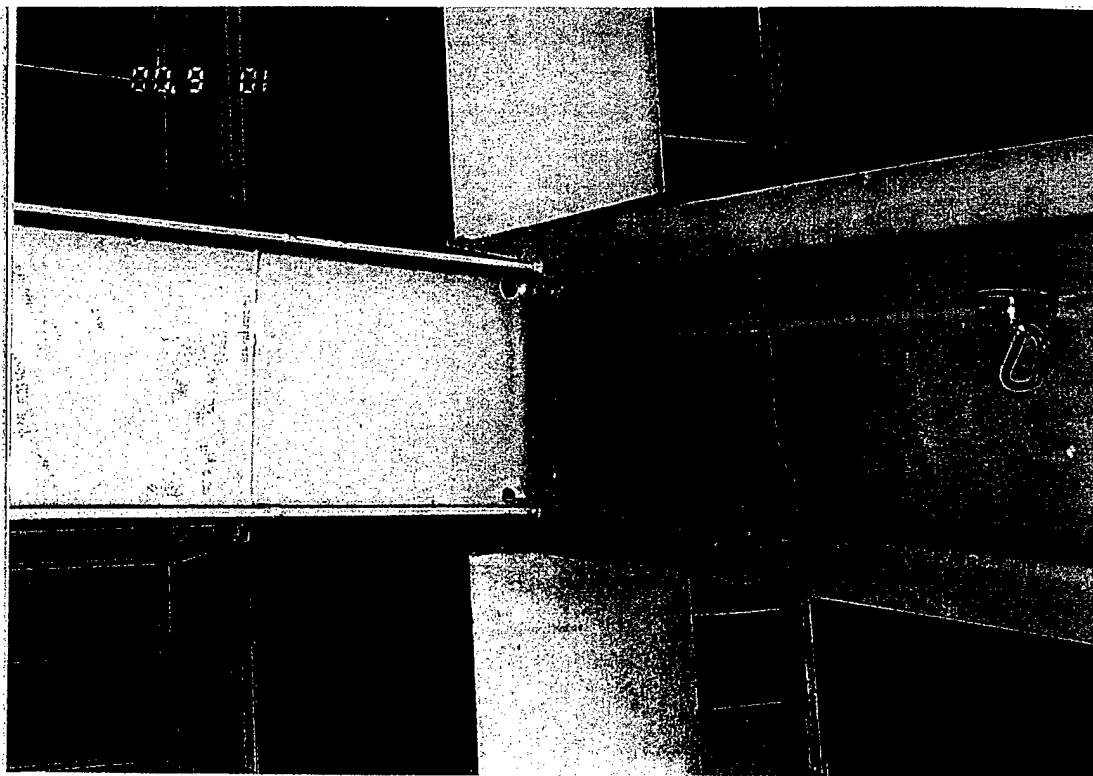


Lower
Granite
Dam

10/06/00

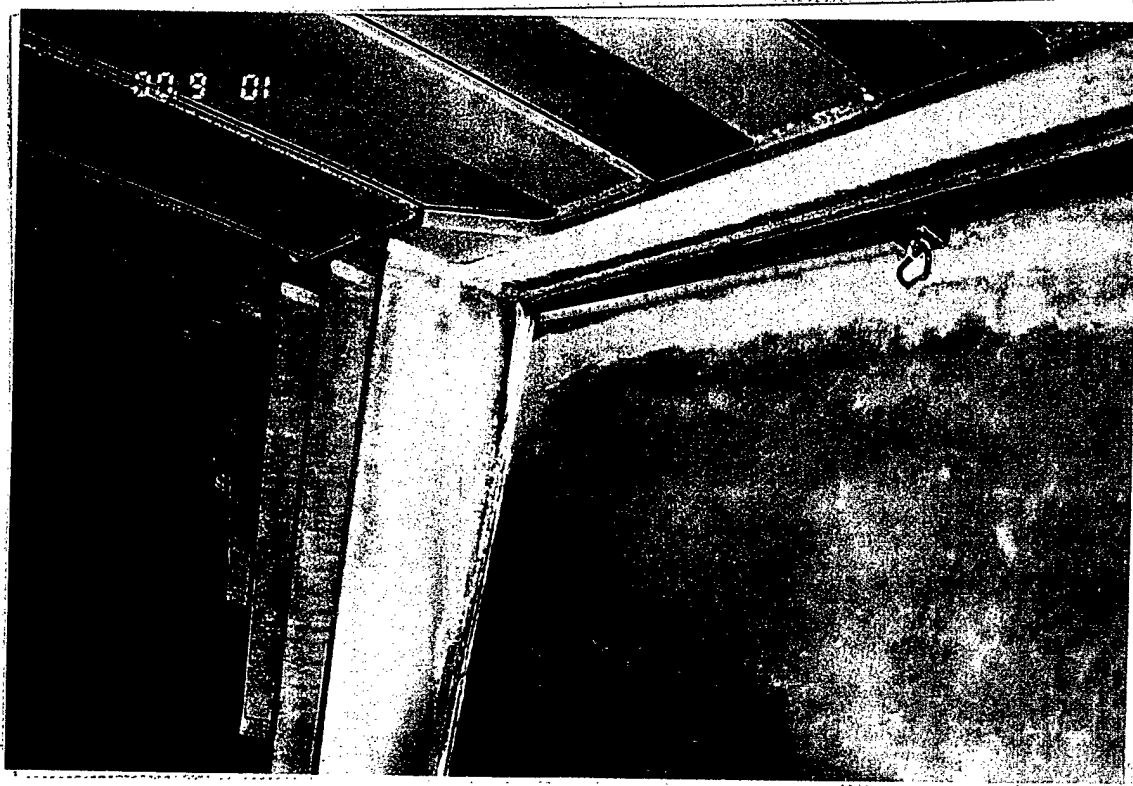
6-8

Gate 6
Leak at center construction joint in
spillway monolith.



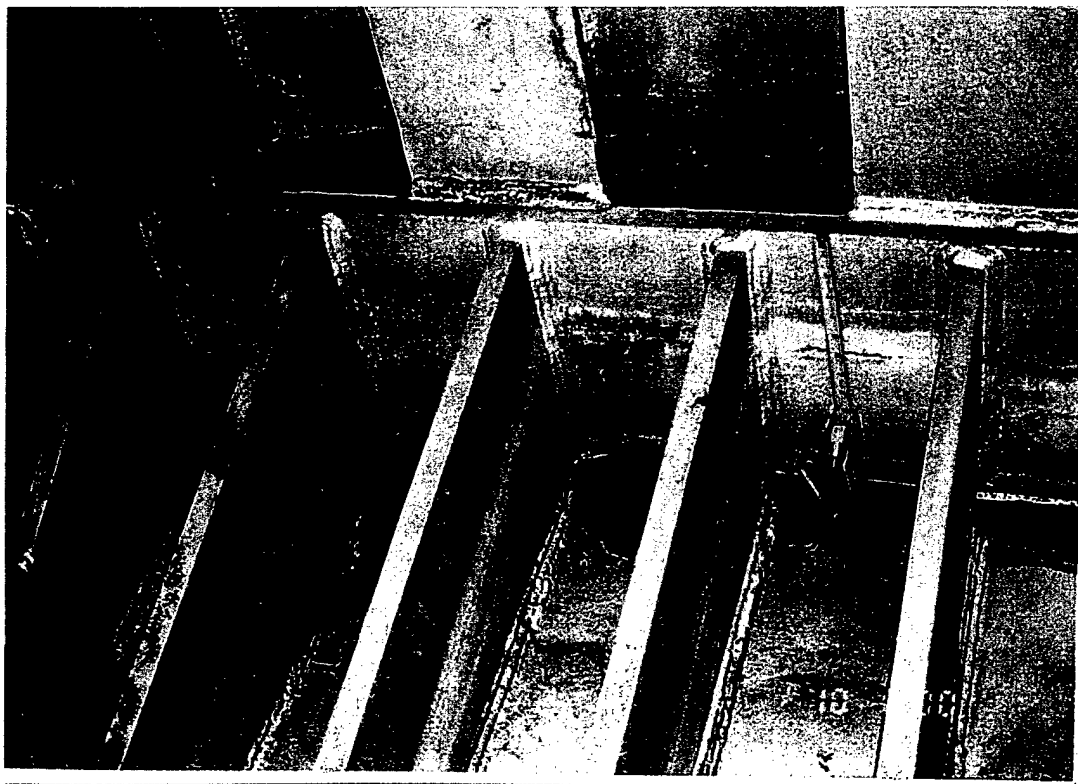
Lower
Granite
Dam
10/06/00
6-9

Gate 6
Right frame, bottom radial strut.
Standing water at upstream end of
strut due to inadequate drainage.



Lower
Granite
Dam
10/06/00
6-10

Gate 6
Right end of bottom horizontal girder,
standing water at upstream side of
girder web and flange.



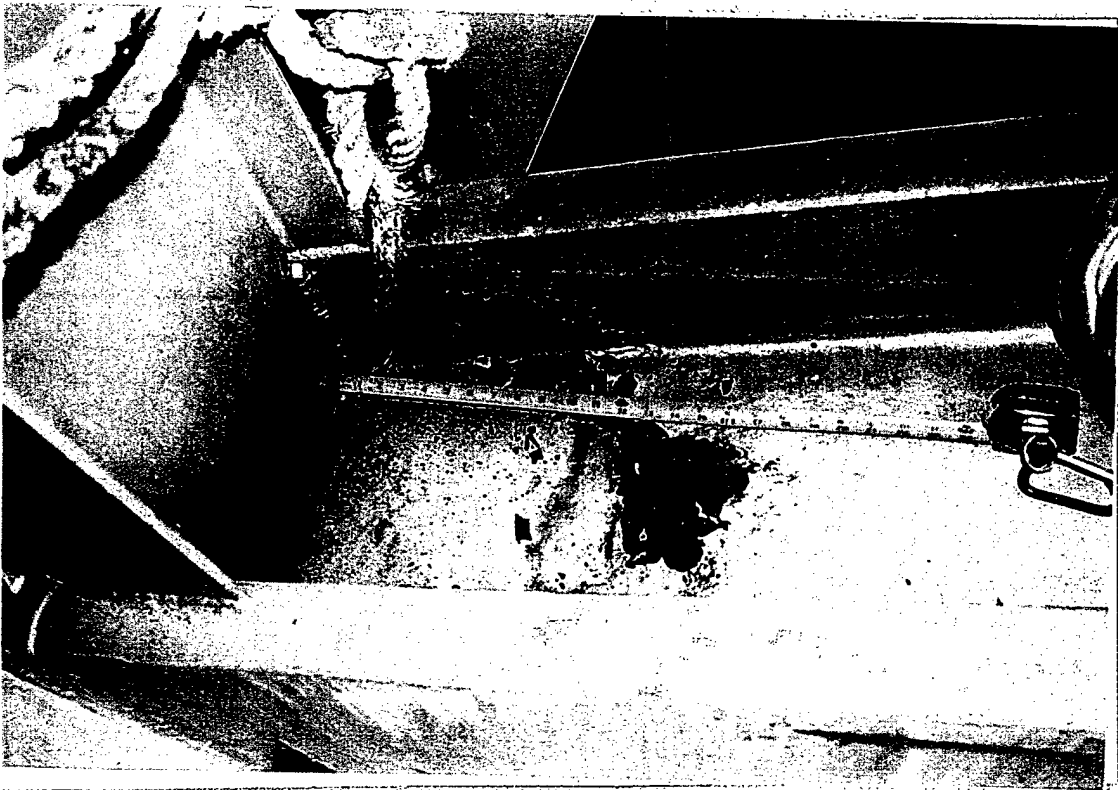
Lower
Granite
Dam

10/06/00

6-11

Gate 6

Right end of bottom horiz. girder.
Standing water, no drainage between
multiple stiffeners. Horizontal girder
to skin plate stiffeners, standing
water, debris and no drainage



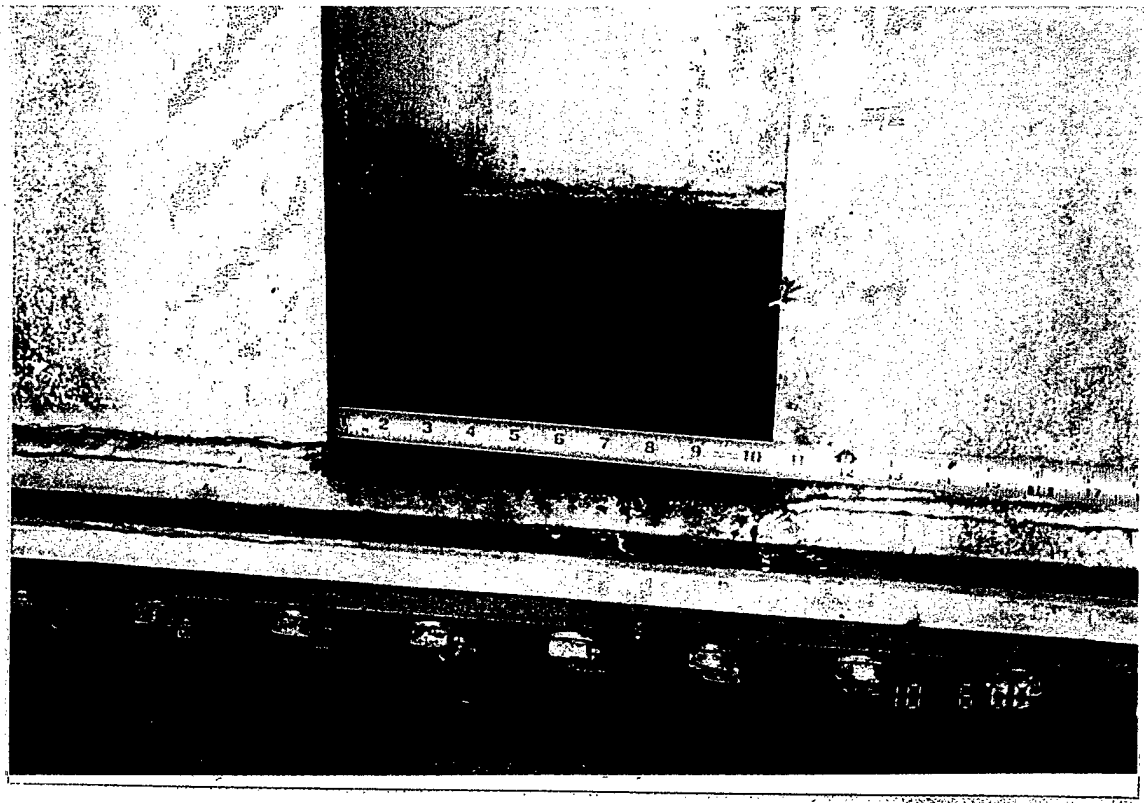
Lower
Granite
Dam

10/06/00

6-12

Gate 6

Left frame, bottom radial strut.
Evidence of standing water at
upstream end of strut due to
inadequate drainage. Light
corrosion.



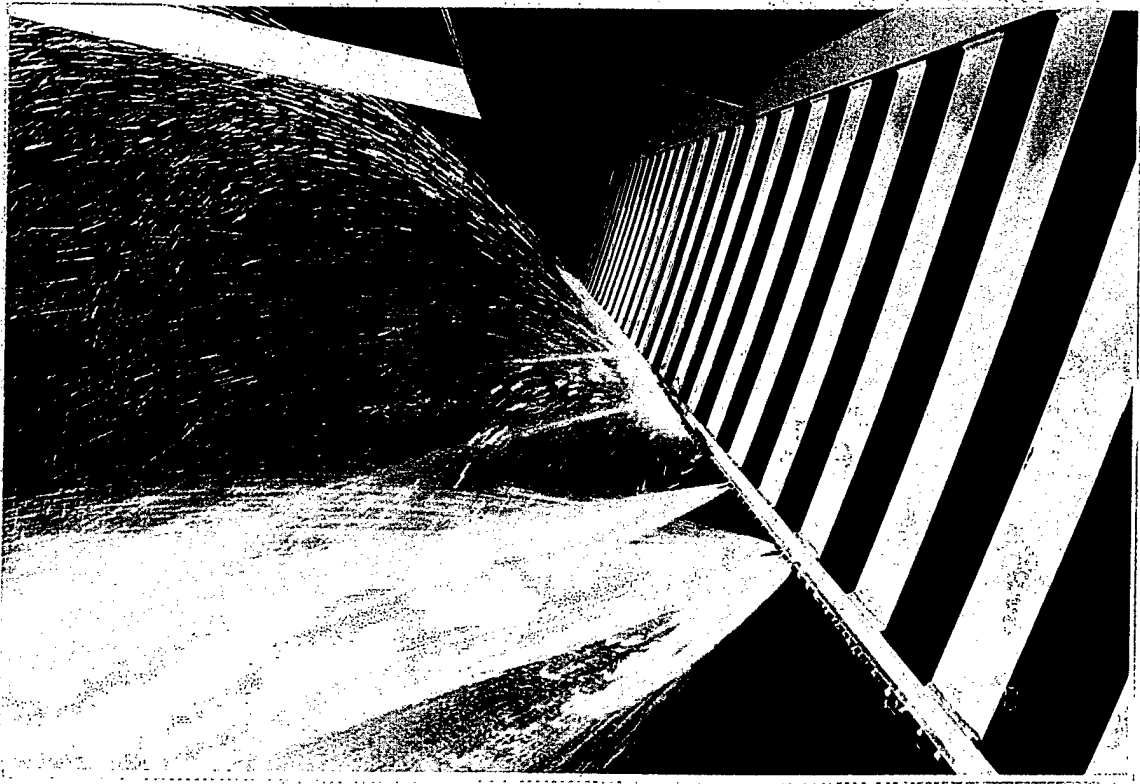
Lower
Granite
Dam

10/06/00

6-13

Gate 6

Bottom seal closure plate looking upstream. Standing water between closure plate, purlin webs and skinplate, typical.



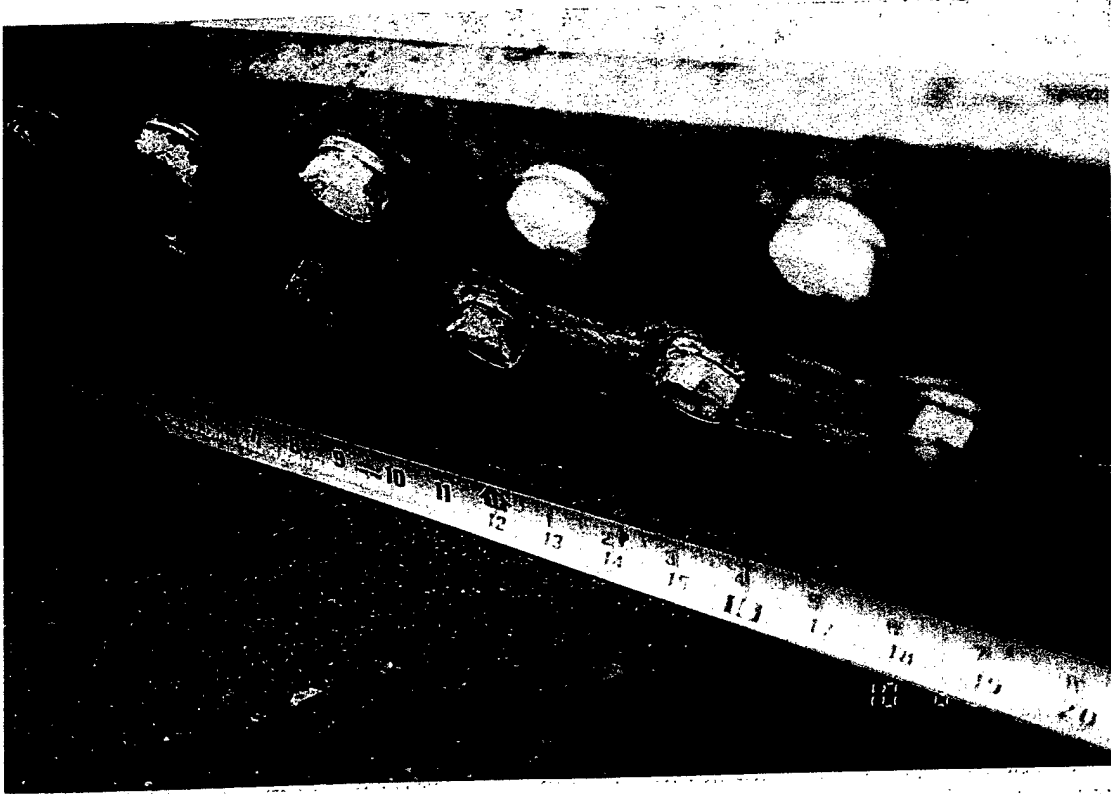
Lower
Granite
Dam

10/06/00

6-14

Gate 6

Leak at center construction joint in spillway monolith, additional bottom seal leaks.



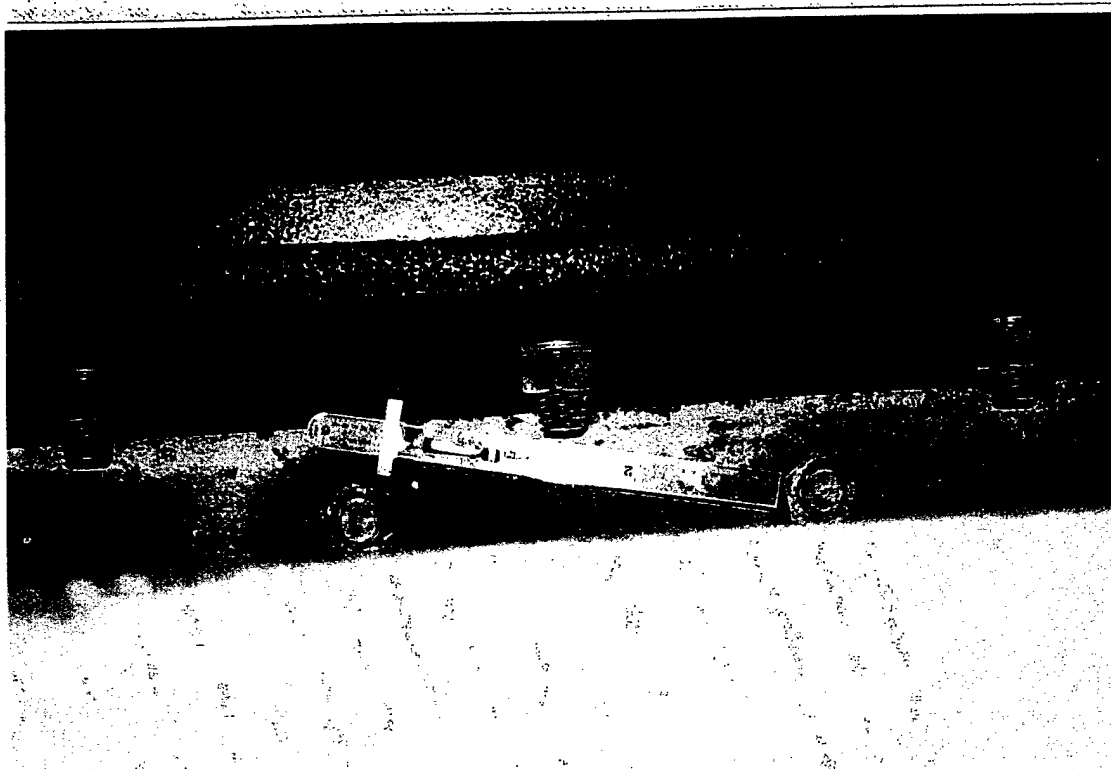
Lower
Granite
Dam

10/06/00

6-15

Gate 6

Bottom seal keeper plate, looking
upstream, typical.



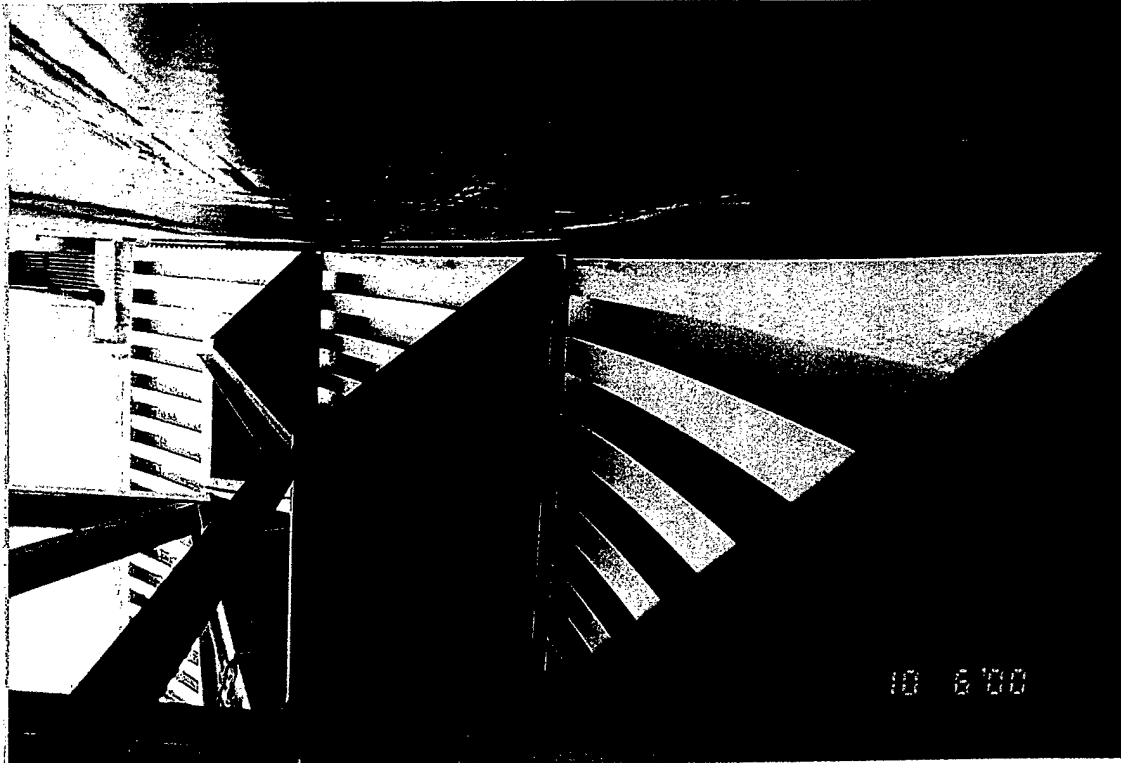
Lower
Granite
Dam

10/06/00

6-16

Gate 6

Side seal, typical.

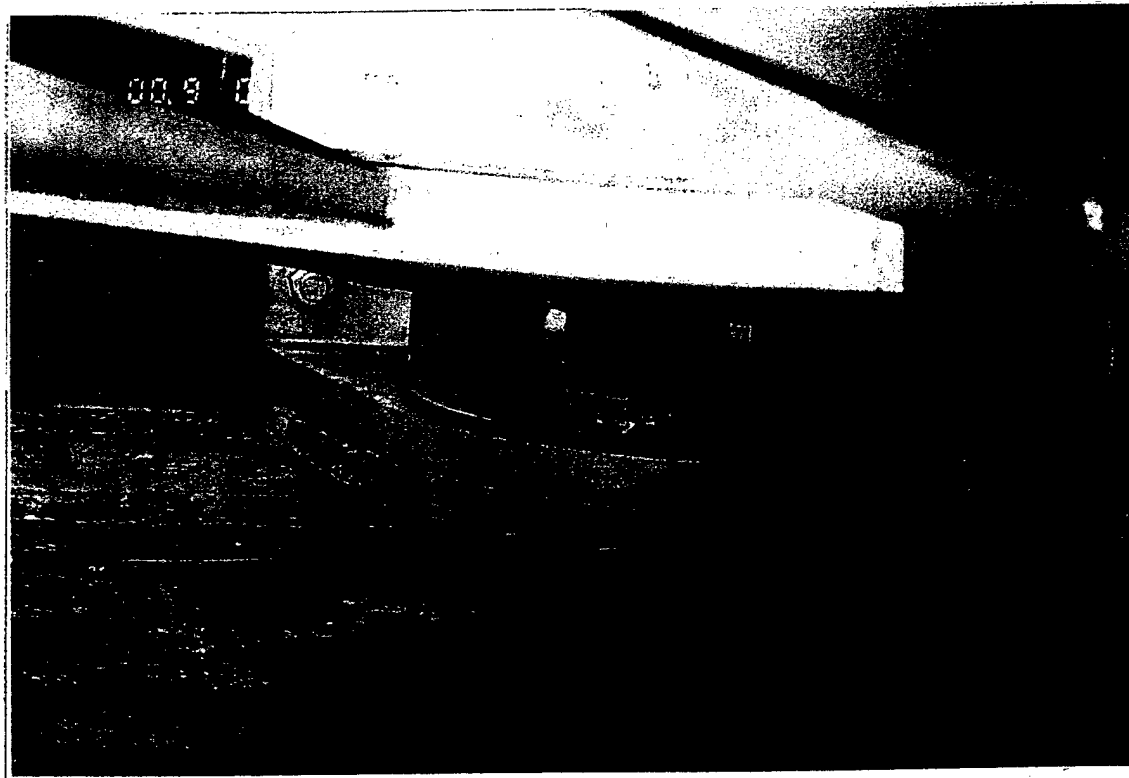


Lower
Granite
Dam

Gate 6
Bottom of left frame horizontal
girders, typical.

10/06/00

6-17

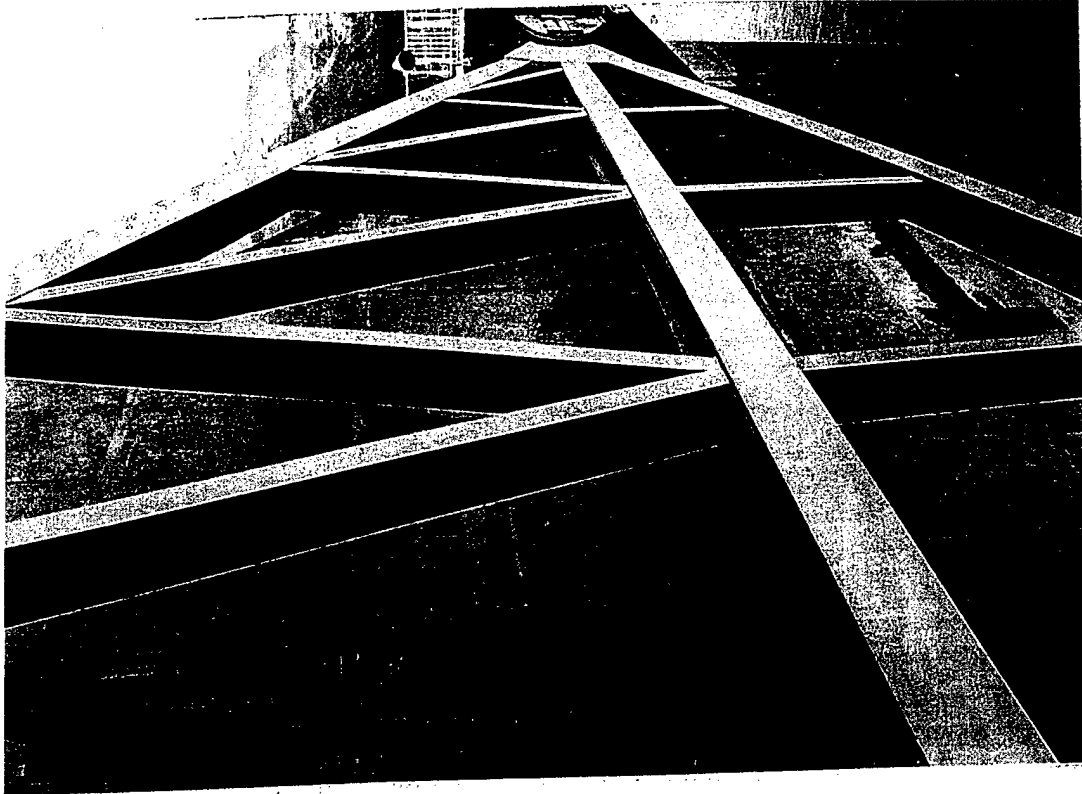


Lower
Granite
Dam

Gate 6
Outside of left trunnion and yoke.
Note: Lubrication lines and expelled
lubrication between trunnion and
yoke.

10/06/00

6-18

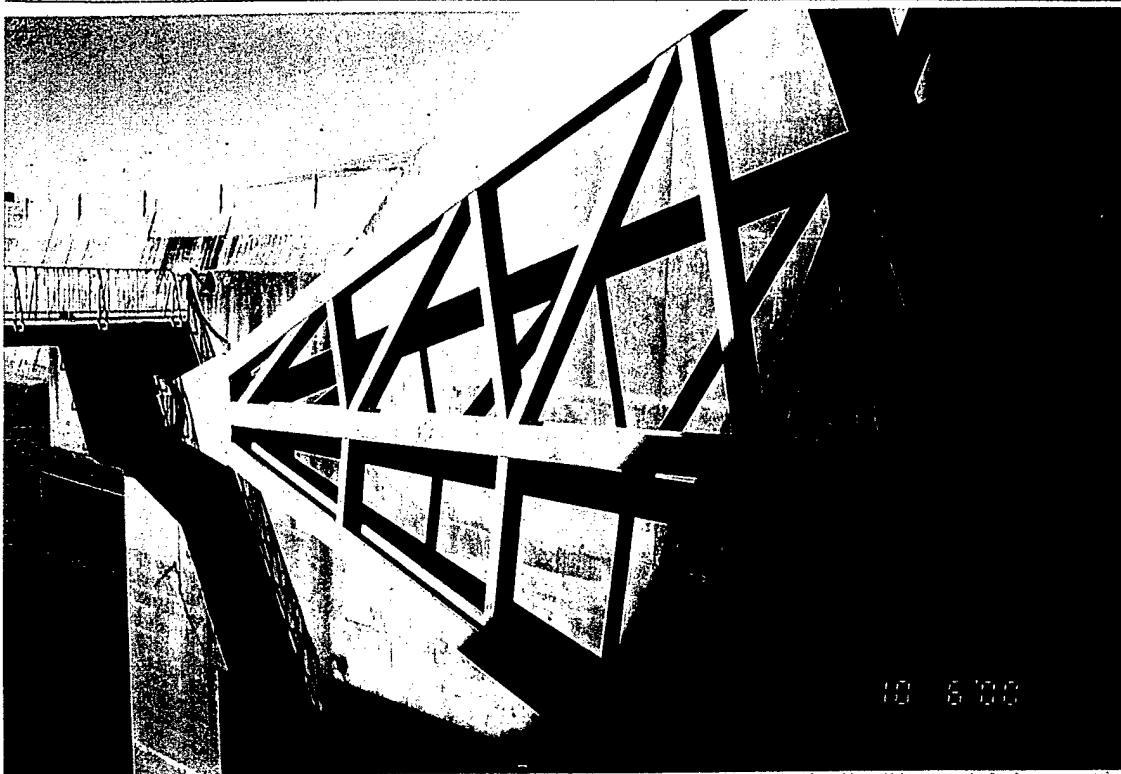


Lower
Granite
Dam

Gate 6
Left frame, typical.

10/06/00

6-19

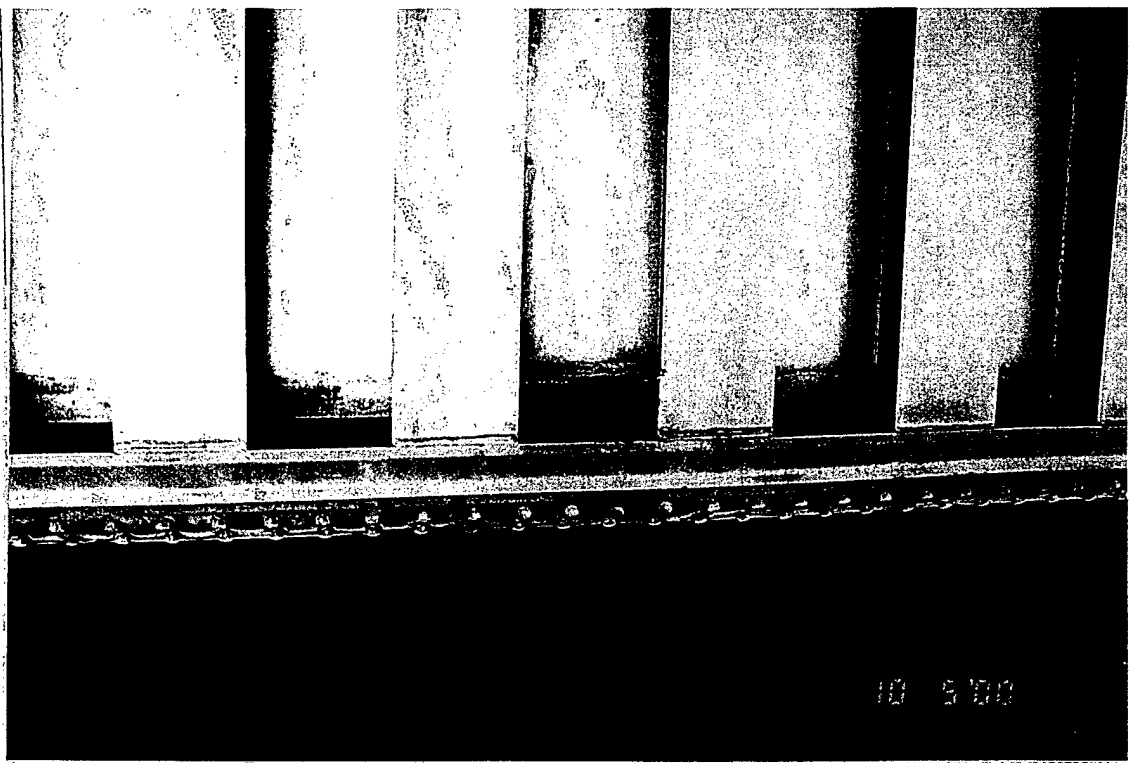


Lower
Granite
Dam

Gate 6
Right frame, typical.

10/06/00

6-20



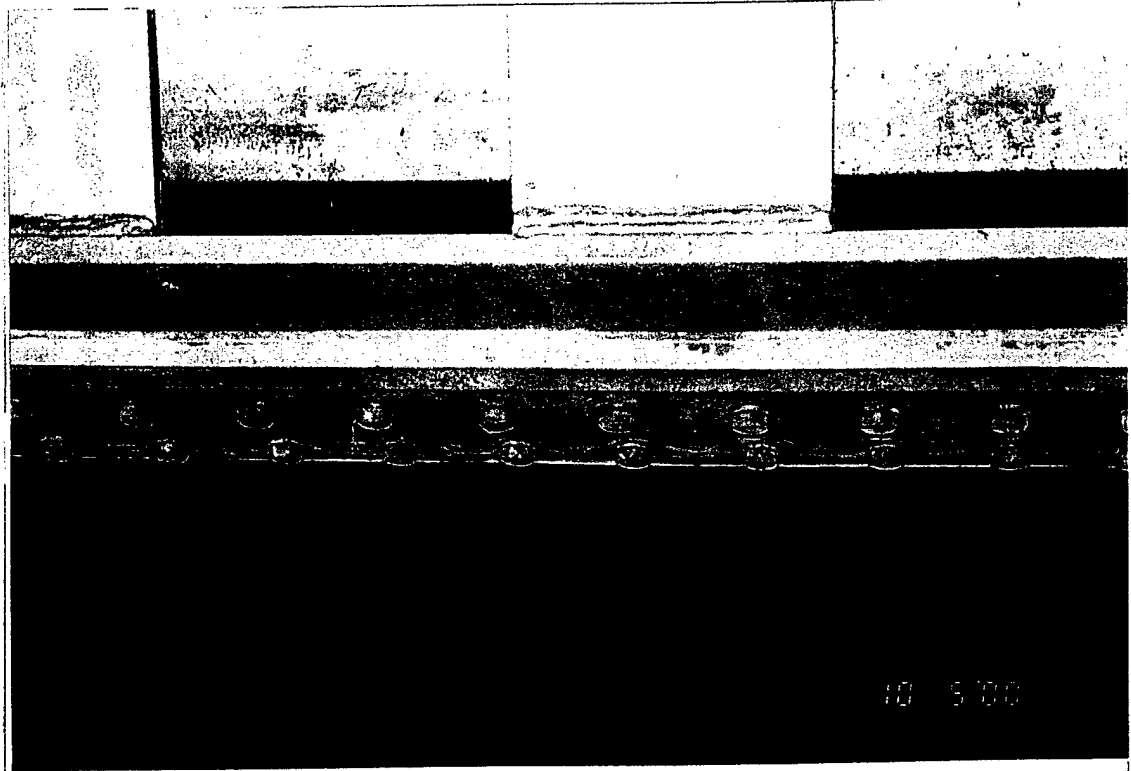
Lower
Granite
Dam

10/05/00

6-21

Gate 6

Bottom seal closure plate and skin plate looking upstream. Standing water between closure plate, purlin webs and skinplate, typical.



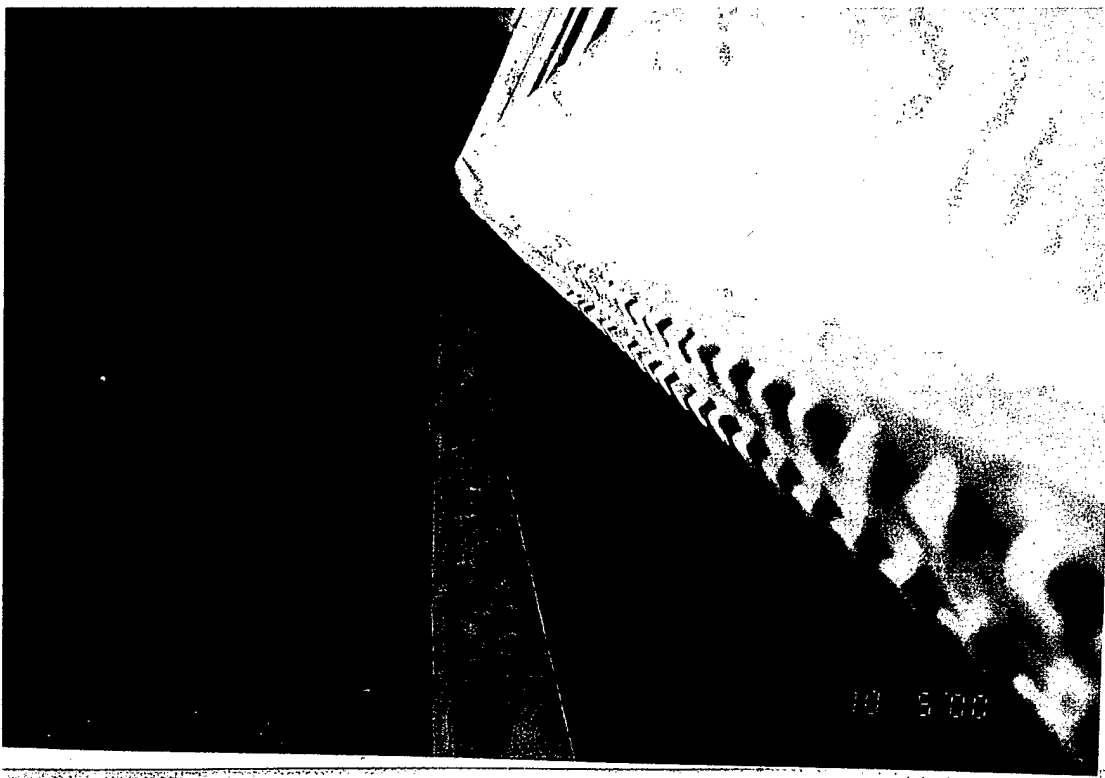
Lower
Granite
Dam

10/05/00

6-22

Gate 6

Bottom seal closure plate looking upstream. Standing water between closure plate, purlin webs and skinplate, typical.



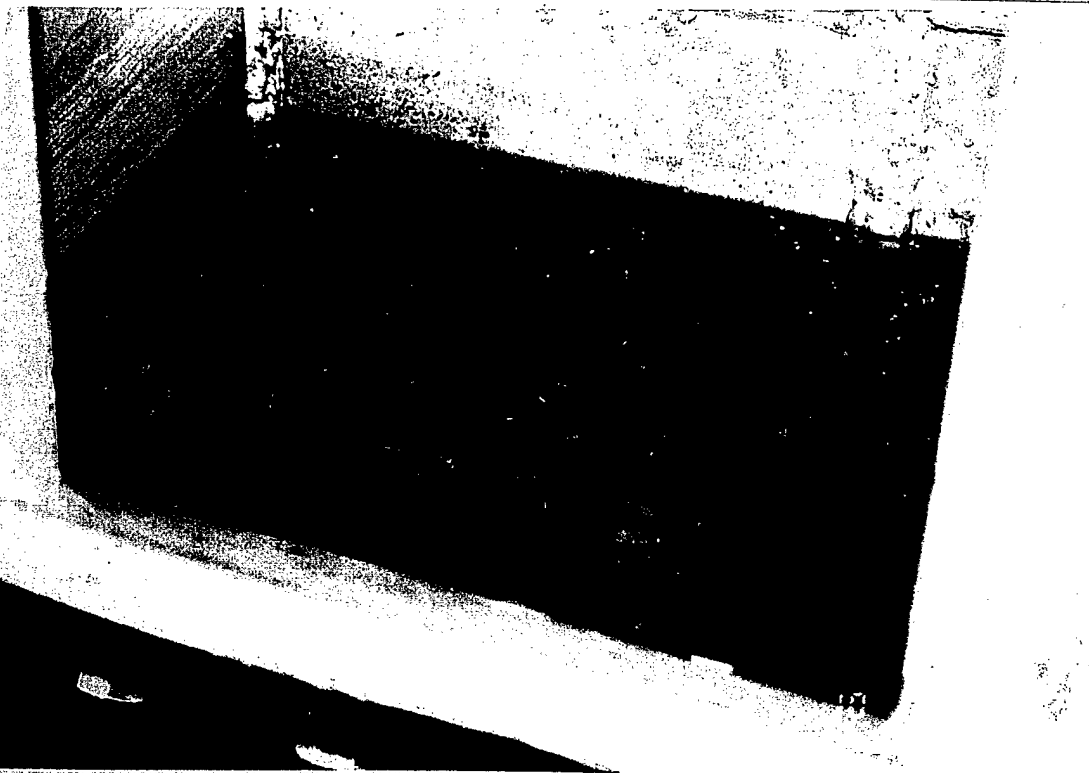
Lower
Granite
Dam

Gate 6

Embedded bottom seal plate, typical.

10/05/00

6-23



Lower
Granite
Dam

Gate 6

Bottom seal closure plate looking upstream. Standing water between closure plate, purlin webs and skinplate, Note: good condition of stainless steel bolts and nuts.

10/05/00

6-24



Lower
Granite
Dam

Gate 6
Skin plate pitting, typical.

10/05/00

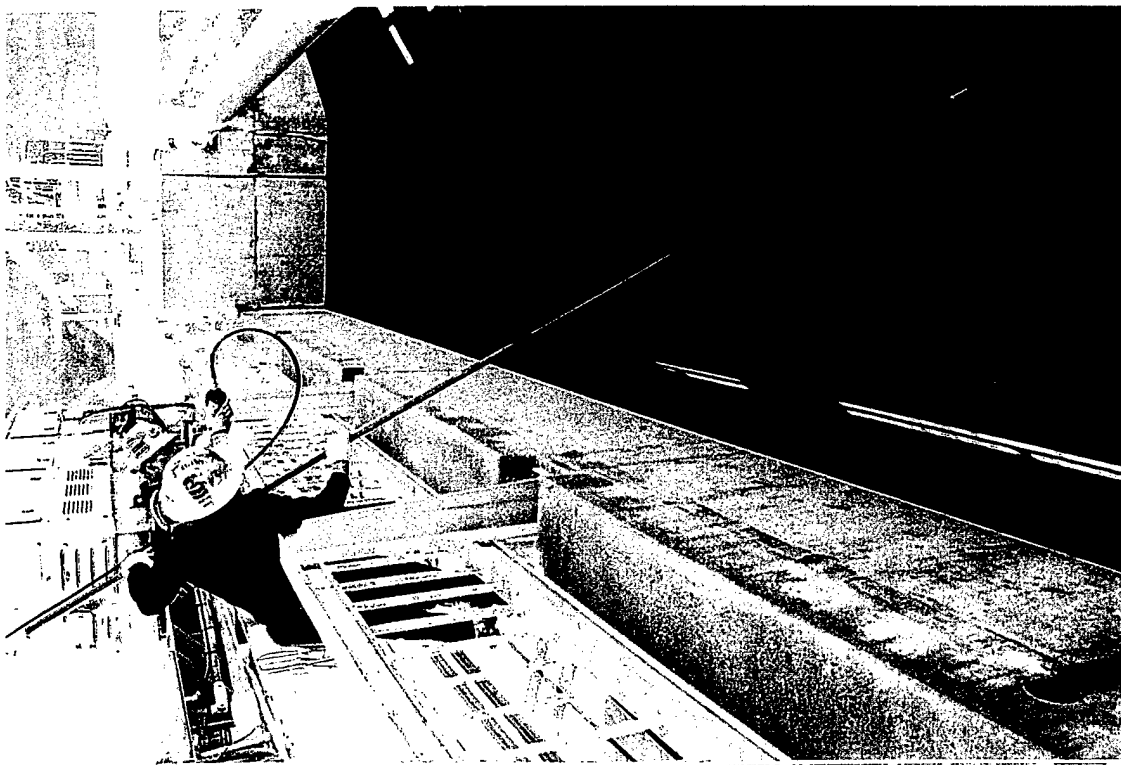
6-25



Lower
Granite
Dam

Gate 6
Typical skin plate condition.

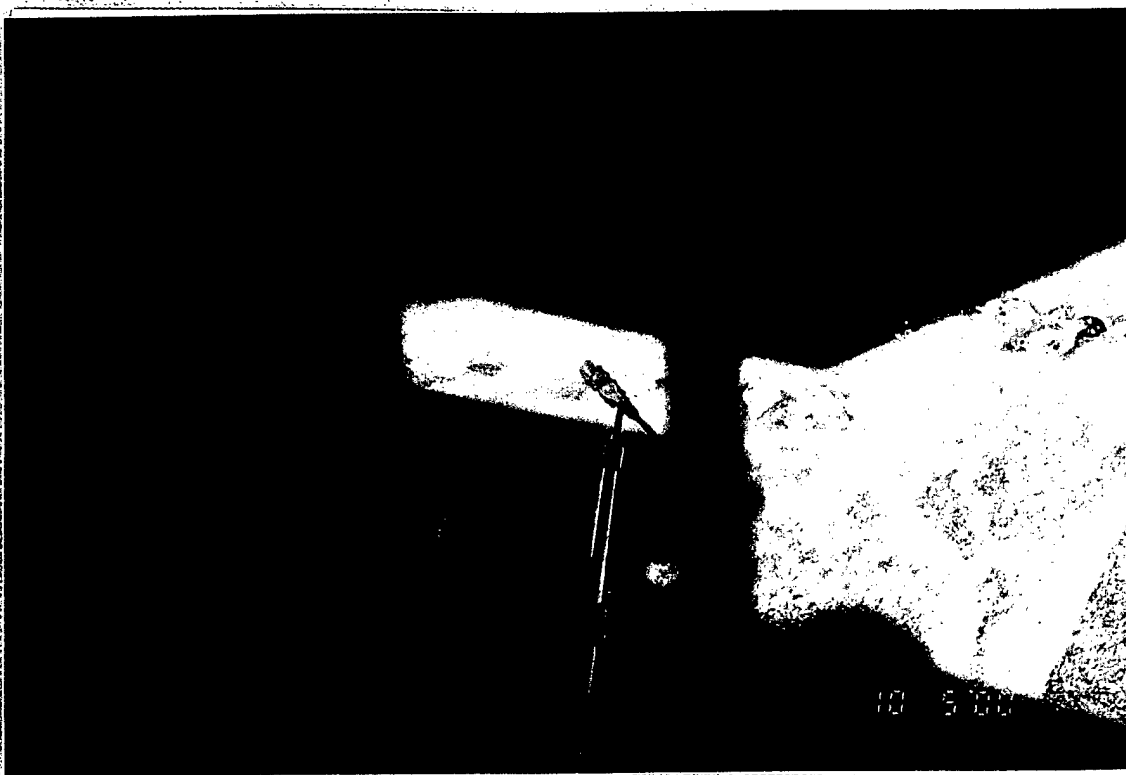
10/05/00



Lower Gate 6
Granite Waterblasting of skin plate, typical.
Dam

10/05/00

6-27



Lower Gate 6
Granite Waterblasting of skin plate, typical.
Dam

10/05/00

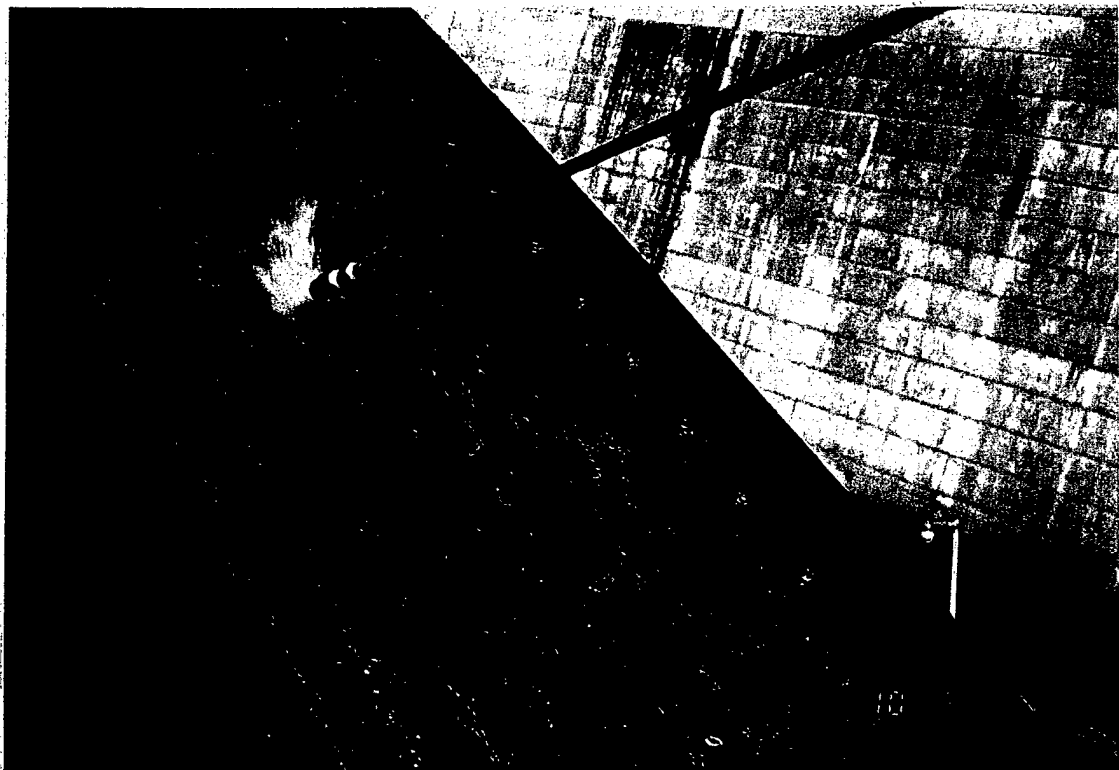
6-28



Lower Gate 6
Granite Skin plate pitting, typical.
Dam

10/05/00

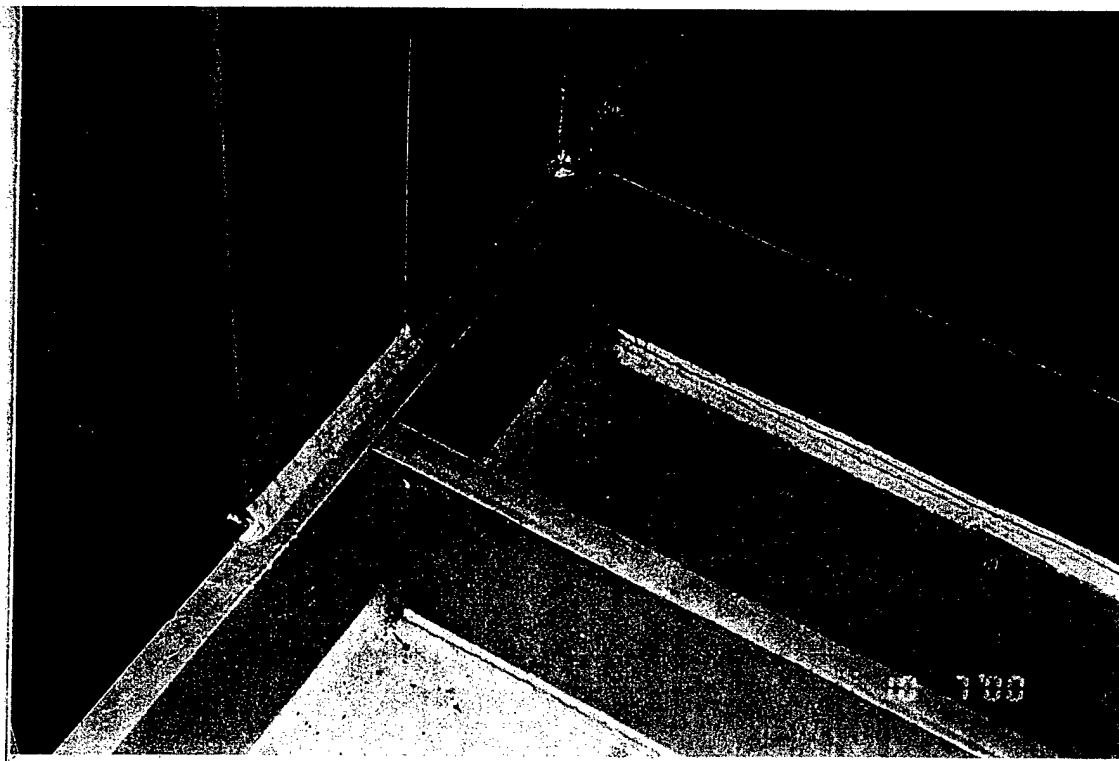
6-29



Lower Gate 6
Granite Typical wear plate condition. Light
Dam grooves due to cable wear, light to
moderate corrosion.

10/05/00

6-30



Lower
Granite
Dam

10/07/00

7-1

Gate 7

Horizontal girder stiffeners at left
frame middle radial strut. Note:
upstream end of stiffeners not welded
to girder flange. Correct per plans.



Lower
Granite
Dam

10/07/00

7-2

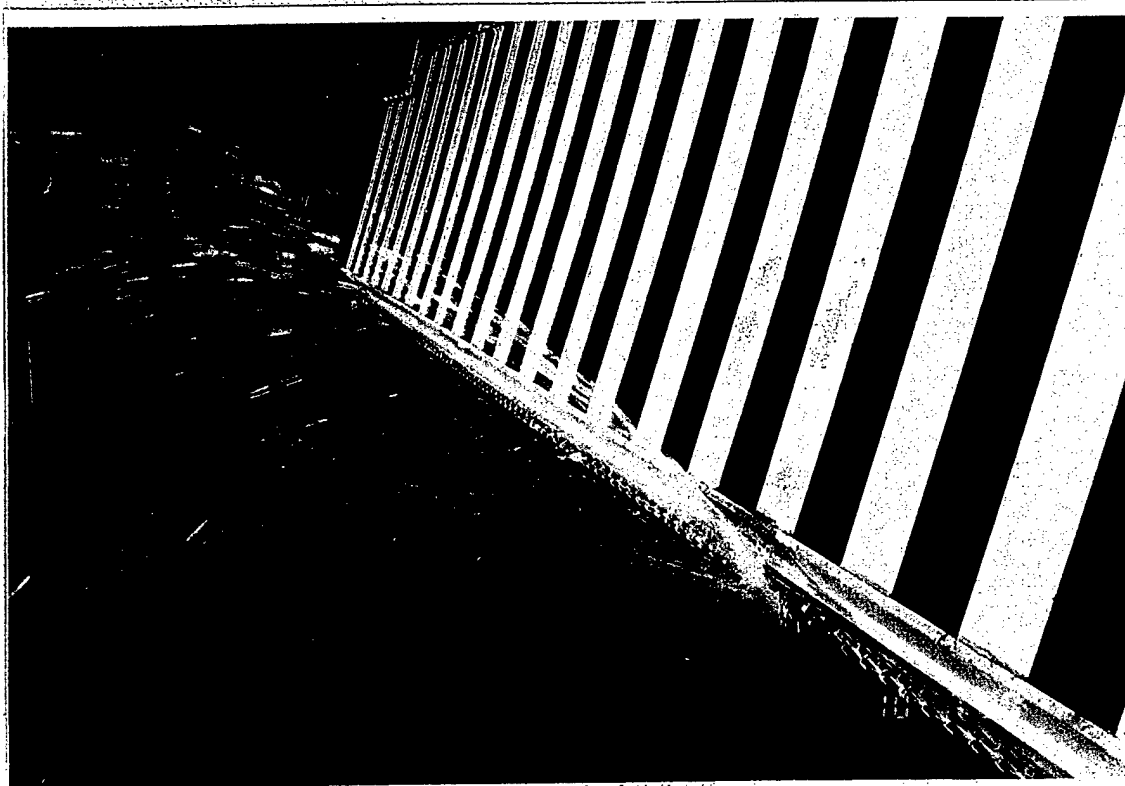
Gate 7

Left end of bottom horizontal girder.
Standing water, no drainage between
multiple stiffeners. Horizontal girder
to skin plate stiffeners, standing
water, debris and no drainage



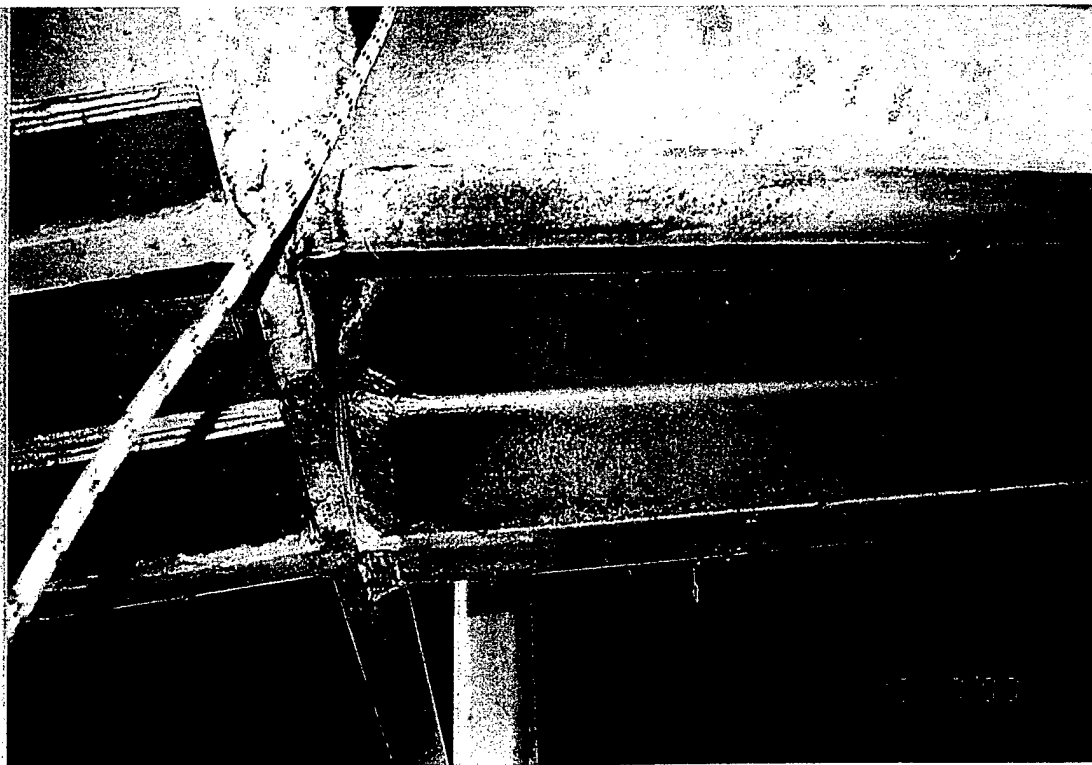
Lower
Granite
Dam
10/07/00
7-3

Gate 7
Bottom seal closure plate looking
upstream. Standing water between
closure plate, purlin webs and
skinplate. Typical.



Lower
Granite
Dam
10/07/00
7-4

Gate 7
Leak at center construction joint in
spillway monolith.



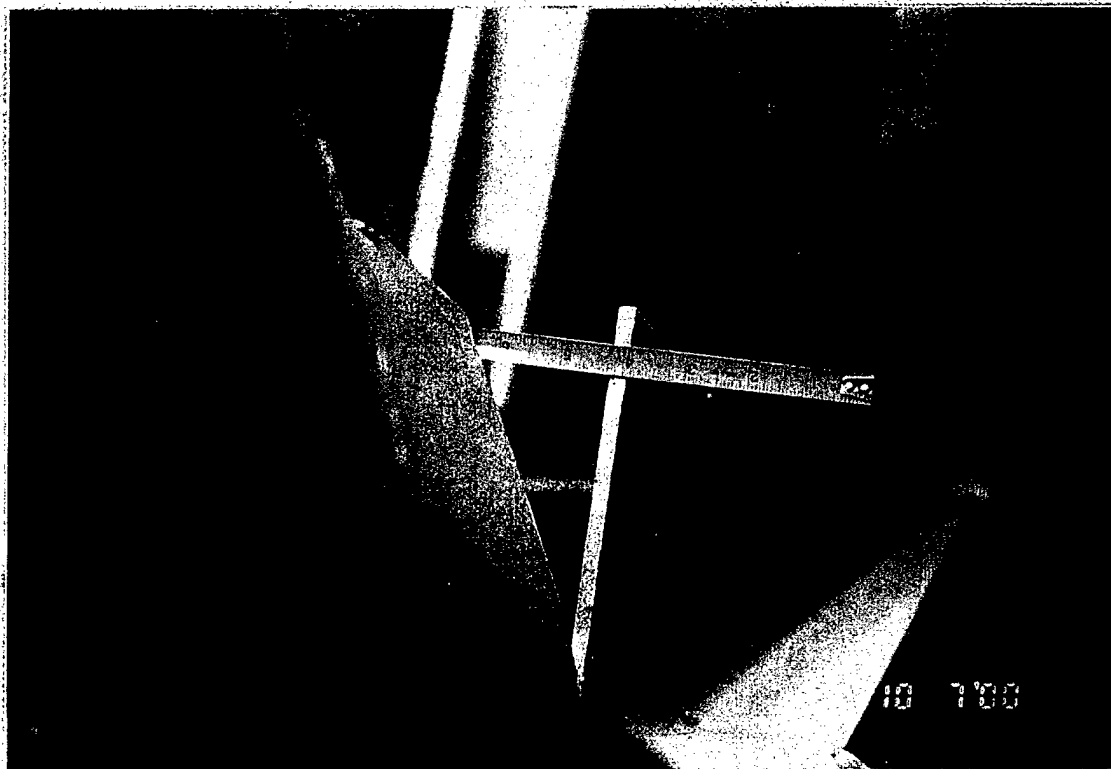
Lower
Granite
Dam

10/07/00

7-5

Gate 7

Bottom of bottom left radial strut.
Light corrosion at connection to
bottom girder. Note: Discolorization
on strut flange due to ultrasonic
testing gel.



Lower
Granite
Dam

10/07/00

7-6

Gate 7

Right horizontal girder bracing A to
K. Deformed web in brace K.



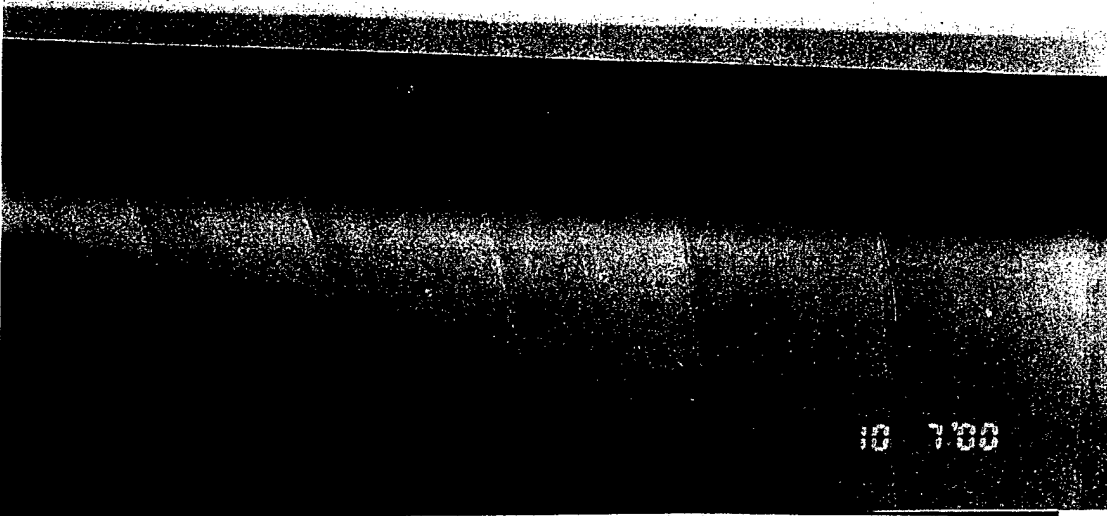
Lower
Granite
Dam

10/07/00

7-7

Gate 7

Top horizontal girder near right radial
strut connection. Light corrosion



Lower
Granite
Dam

10/07/00

7-8

Gate 7

Upstream surface of skin plate,
typical. Note: Weld lines for purlins
visible through 3/8" skin plate.



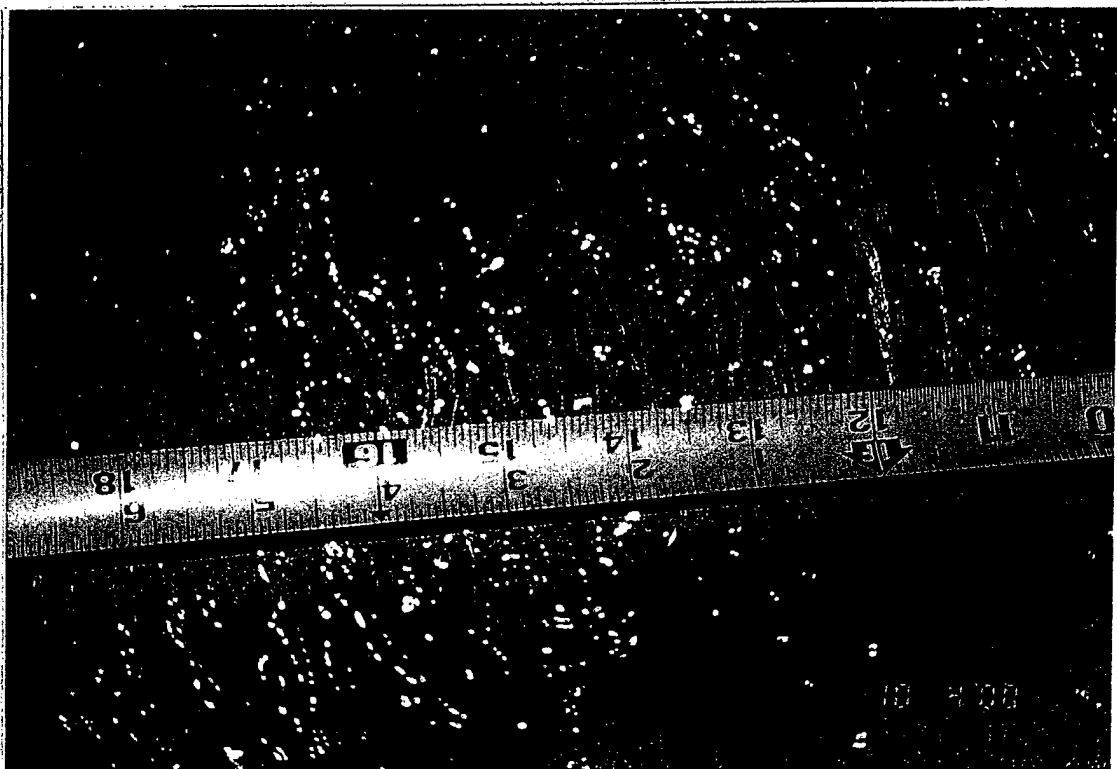
Lower
Granite
Dam

10/04/00

7-9

Gate 7

Bottom seal closure plate looking
upstream. Standing water between
closure plate, purlin webs and
skinplate. Typical.



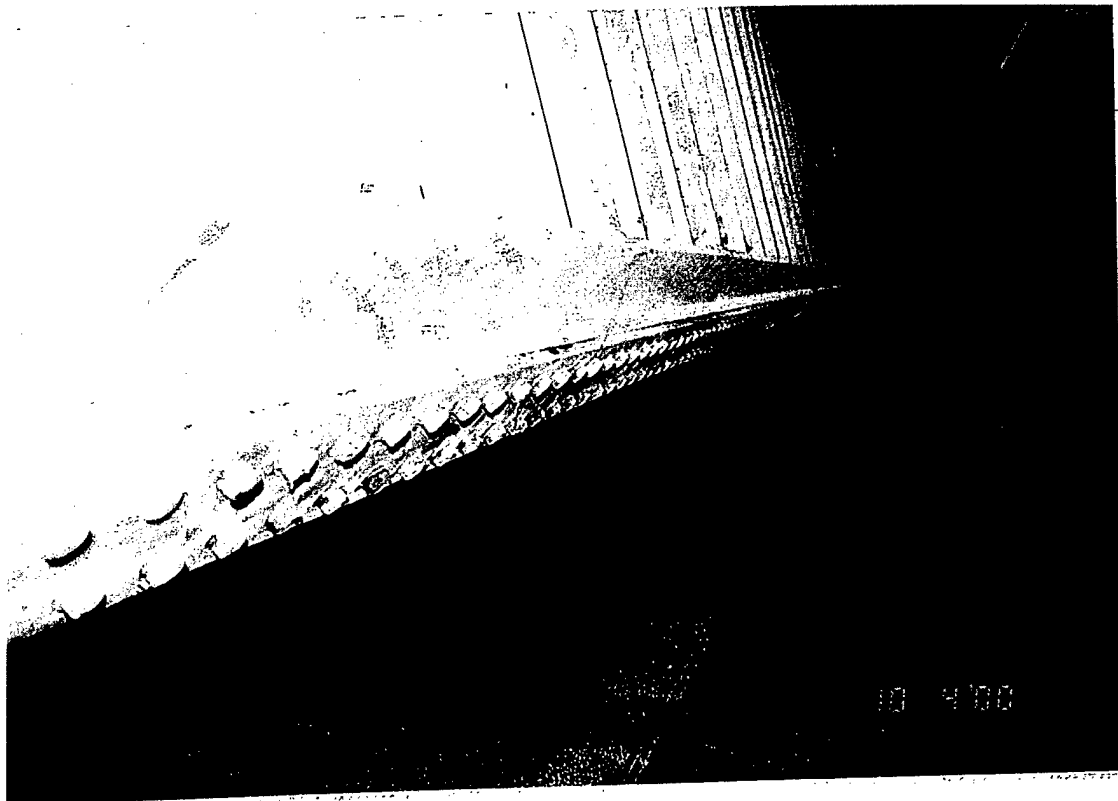
Lower
Granite
Dam

10/04/00

7-10

Gate 7

Close up embedded bottom seal plate,
typical.



Lower
Granite
Dam

10/04/00

7-11

Gate 7

Bottom seal keeper plate and
embedded bottom seal plate, typical.



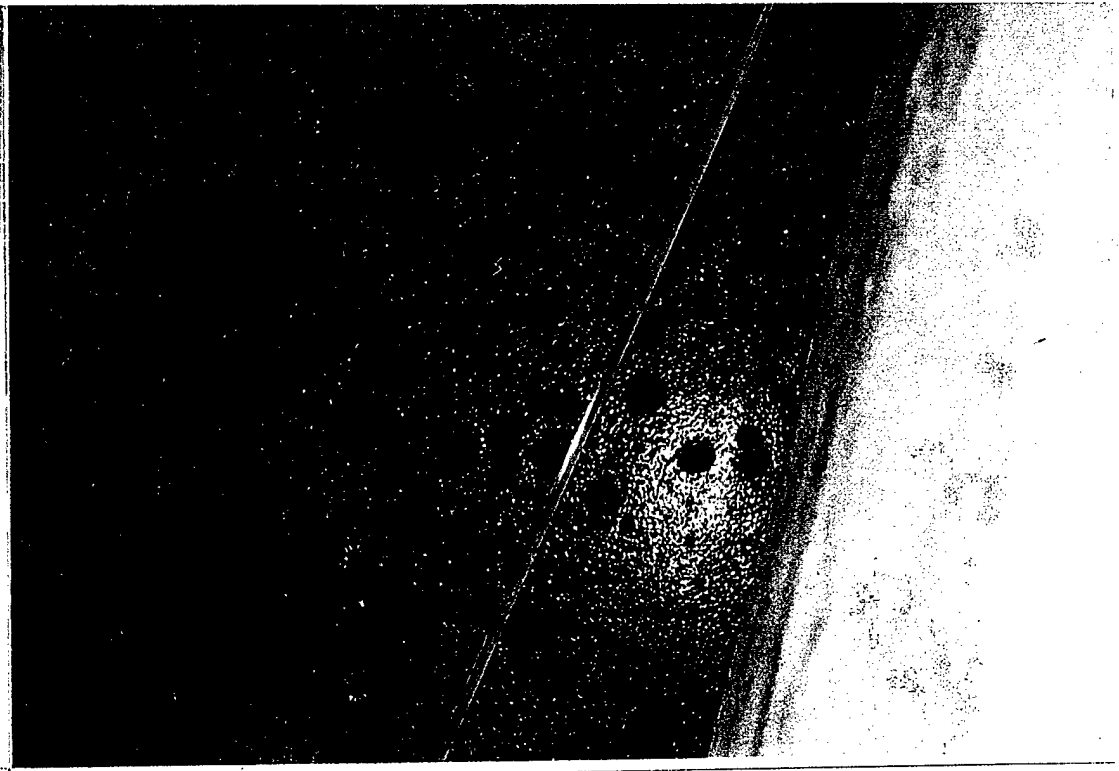
Lower
Granite
Dam

10/04/00

7-12

Gate 7

Skin plate pitting, typical.

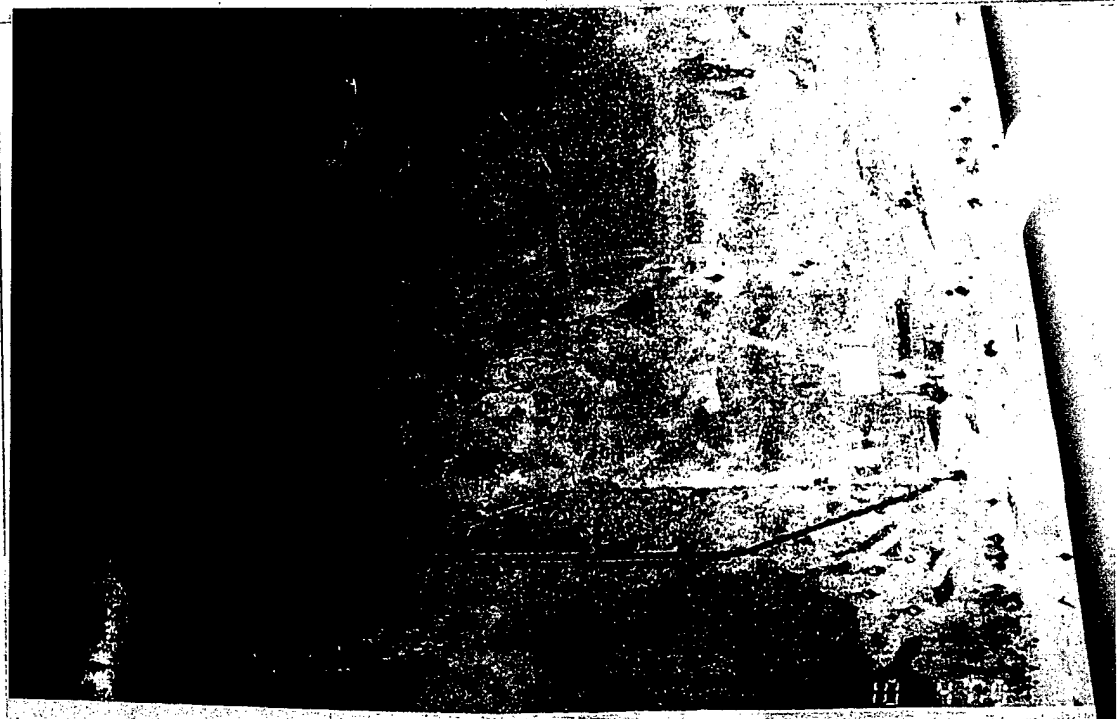


Lower
Granite
Dam

10/04/00

7-13

Gate 7
Skin plate pitting, typical.



Lower
Granite
Dam

10/04/00

7-14

Gate 7
Typical skin plate condition. Heavy
pitting. Note: Pitting often appears
to be oriented in lines associated
with scratches.

00.4 01

Lower
Granite
Dam

10/04/00

7-15

Gate 7

Skin plate pitting, typical. Note:
Pitting appears to be oriented in line
associated with scratch.



Lower
Granite
Dam

10/04/00

7-16

Gate 7

Typical wear plate condition. Light
grooves due to cable wear, light to
moderate corrosion.



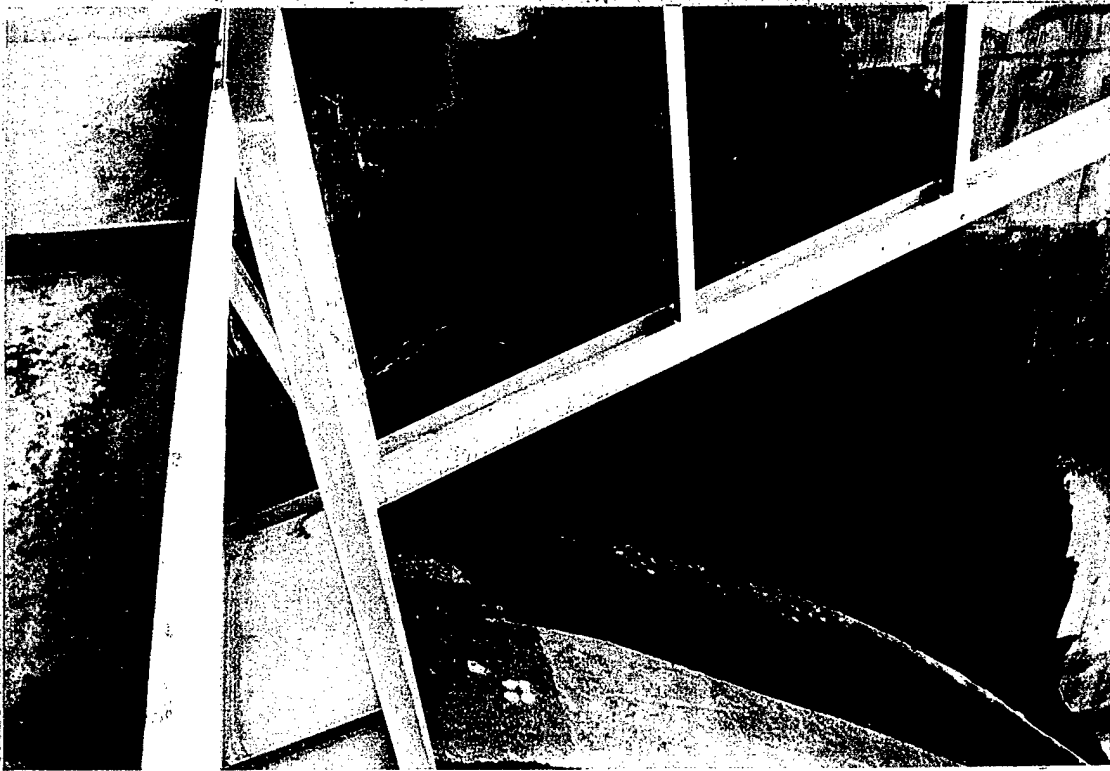
Lower
Granite
Dam

10/07/00

8-1

Gate 8

Middle horizontal girder at
connection to middle right strut.
Debris and evidence of standing
water, light corrosion.



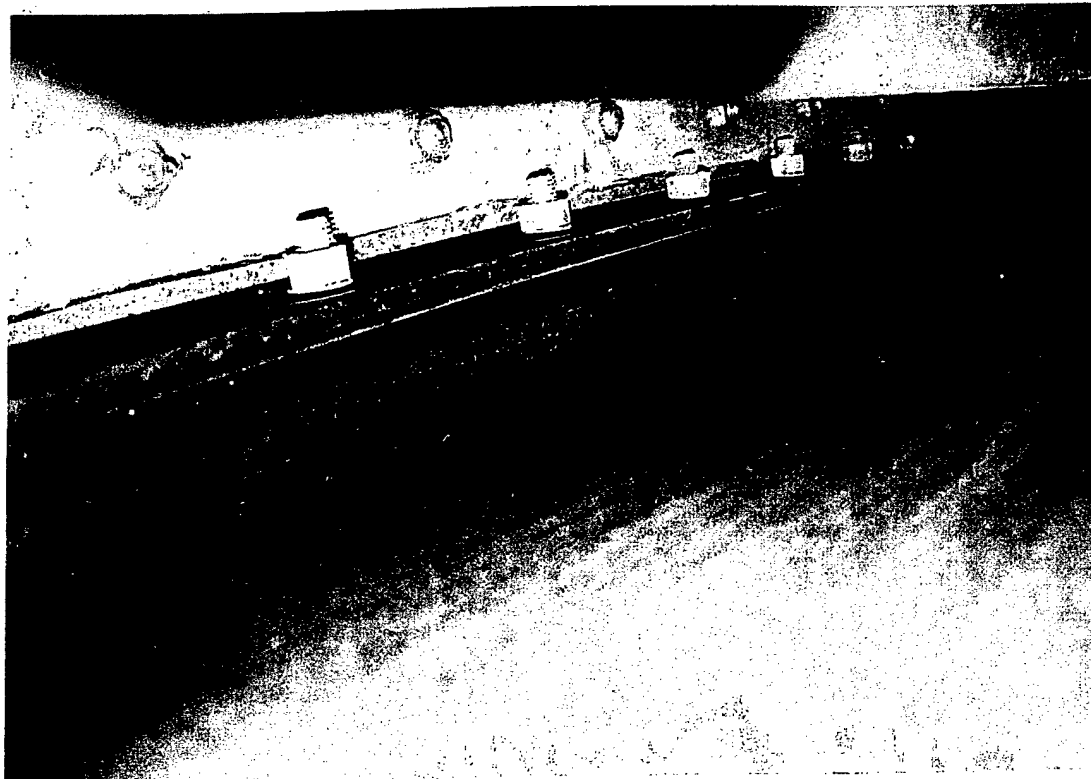
Lower
Granite
Dam

10/07/00

8-2

Gate 8

Bottom corner leak at left frame.



Lower
Granite
Dam

10/07/00

8-3

Gate 8
Side seal, typical.

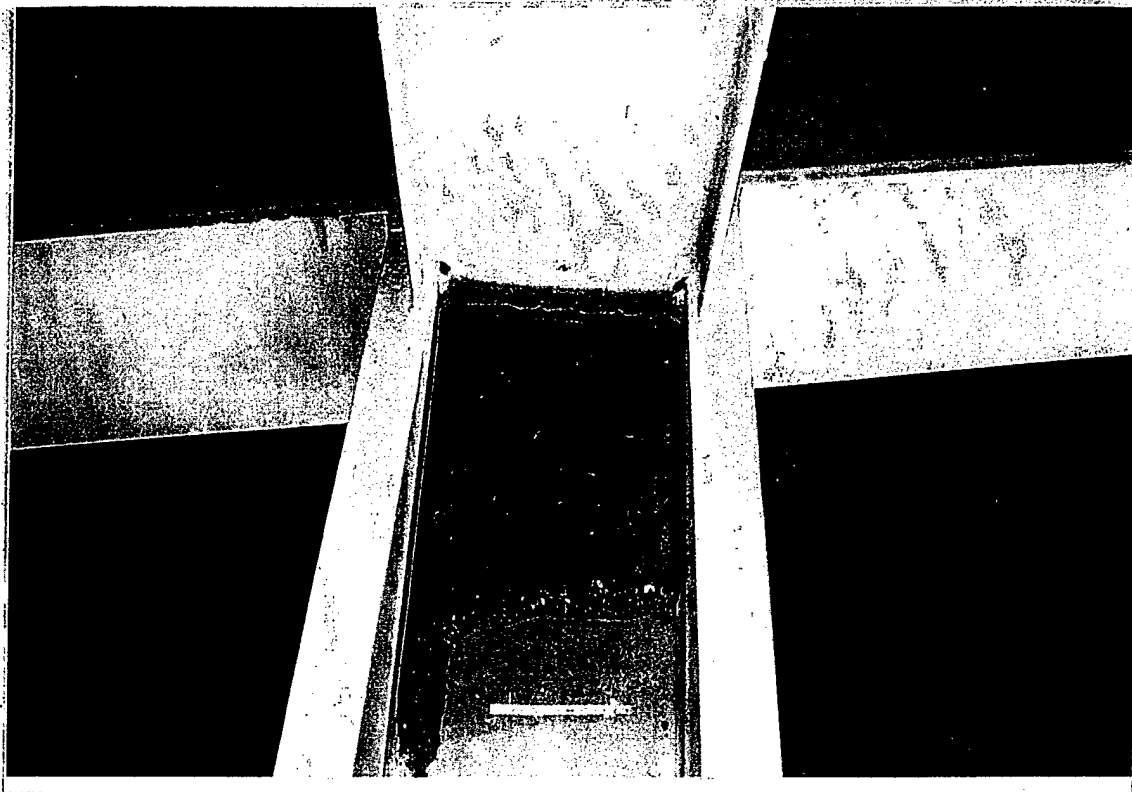


Lower
Granite
Dam

10/07/00

8-4

Gate 8
Bottom right corner seal leak.



Lower
Granite
Dam

10/07/00

8-5

Gate 8

Upstream end of bottom right strut.
Standing water due to inadequate
drainage.



Lower
Granite
Dam

10/07/00

8-6

Gate 8

Right upstream end of bottom
horizontal girder. Standing water at
upstream flange and web.



Lower
Granite
Dam

10/07/00

8-7

Gate 8

Right end of bottom horiz. girder.
Standing water, no drainage between
multiple stiffeners. Horizontal girder
to skin plate stiffeners, standing
water, debris and no drainage



Lower
Granite
Dam

10/07/00

8-8

Gate 8

Bottom seal keeper plate and leak at
center construction joint in spillway
monolith.



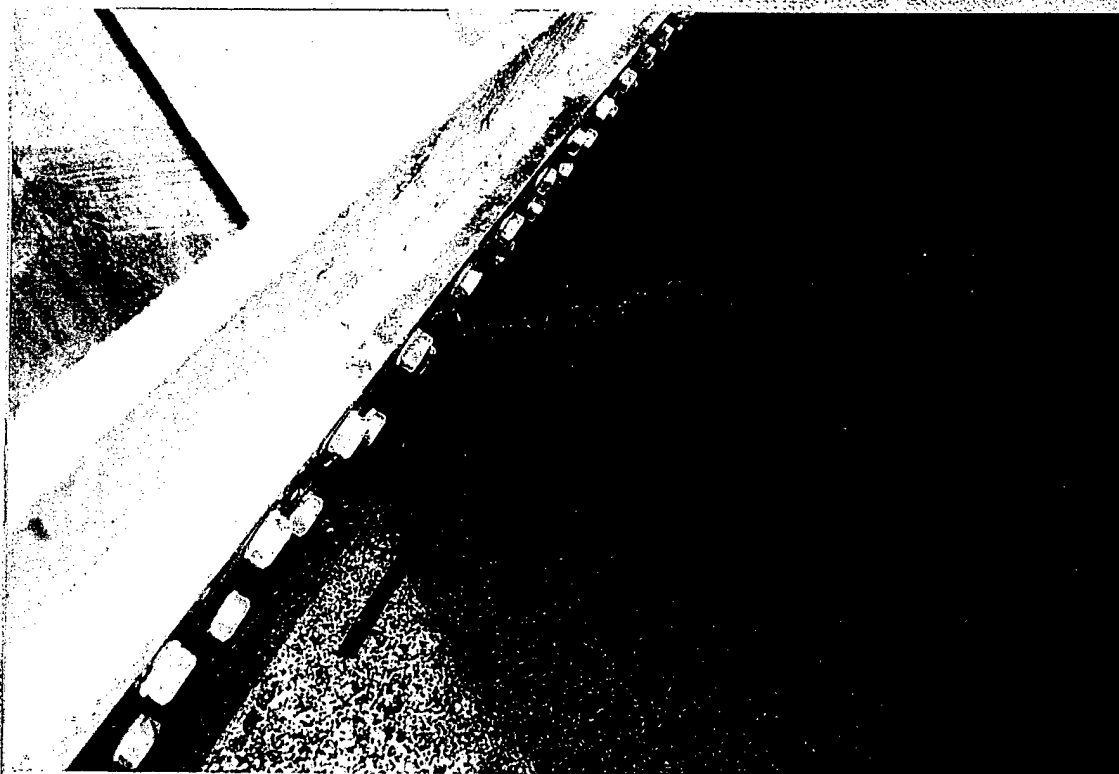
Lower
Granite
Dam

10/07/00

8-9

Gate 8

Bottom seal closure plate looking
upstream. Standing water between
closure plate, purlin webs and
skinplate. Typical.



Lower
Granite
Dam

10/07/00

8-10

Gate 8

Downstream side of embedded
bottom seal plate and small bottom
left corner leak.



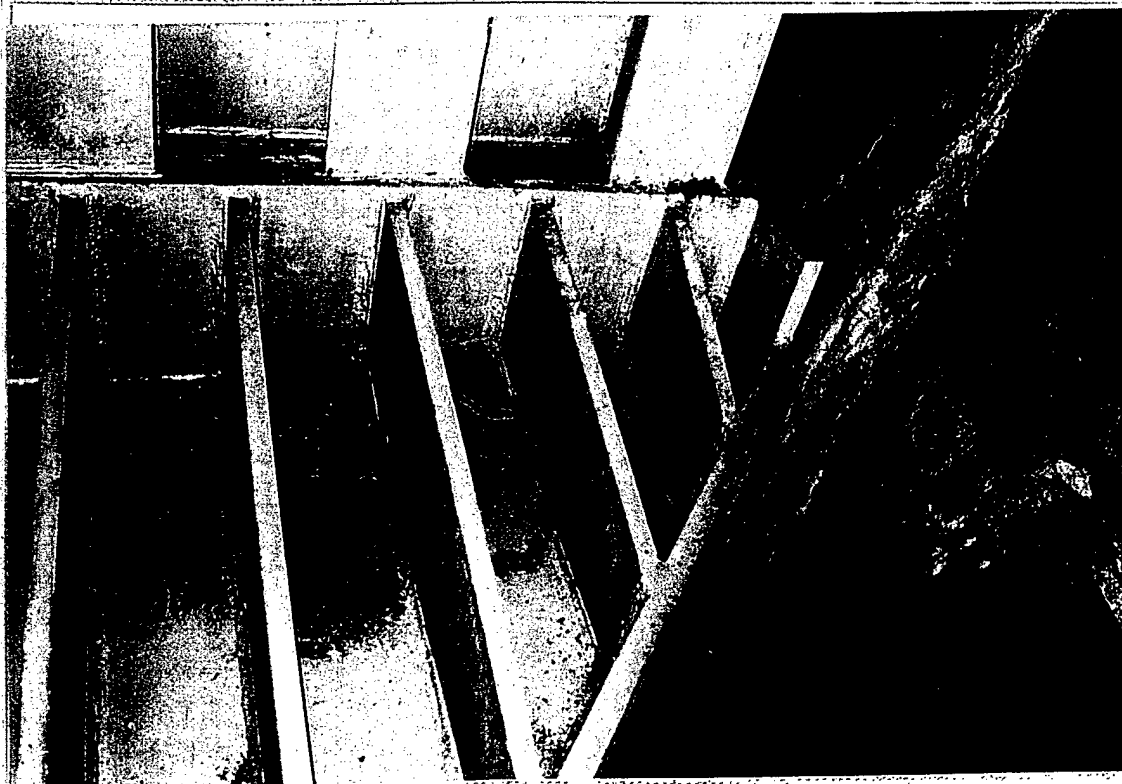
Lower
Granite
Dam

10/07/00

8-11

Gate 8

Spillway looking toward left side of
gate. Bottom corner leak.



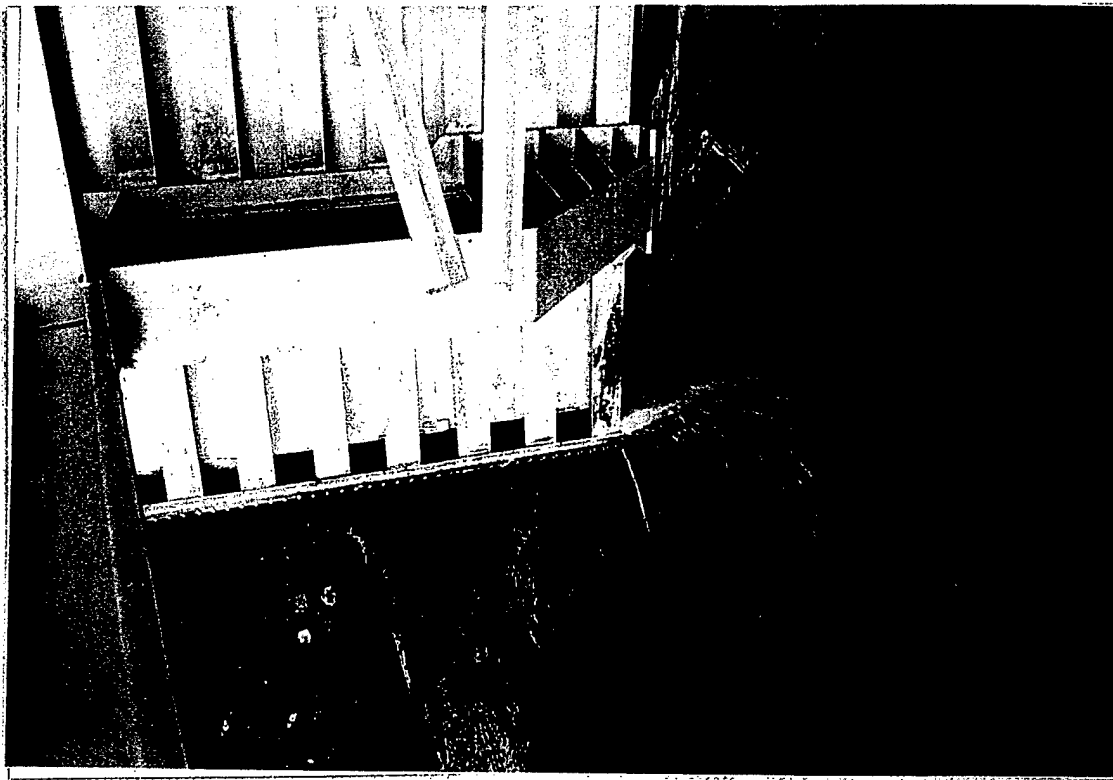
Lower
Granite
Dam

10/07/00

8-12

Gate 8

Left end of bottom horiz. girder.
Standing water, no drainage between
multiple stiffeners. Horizontal girder
to skin plate stiffeners, debris and no
drainage.

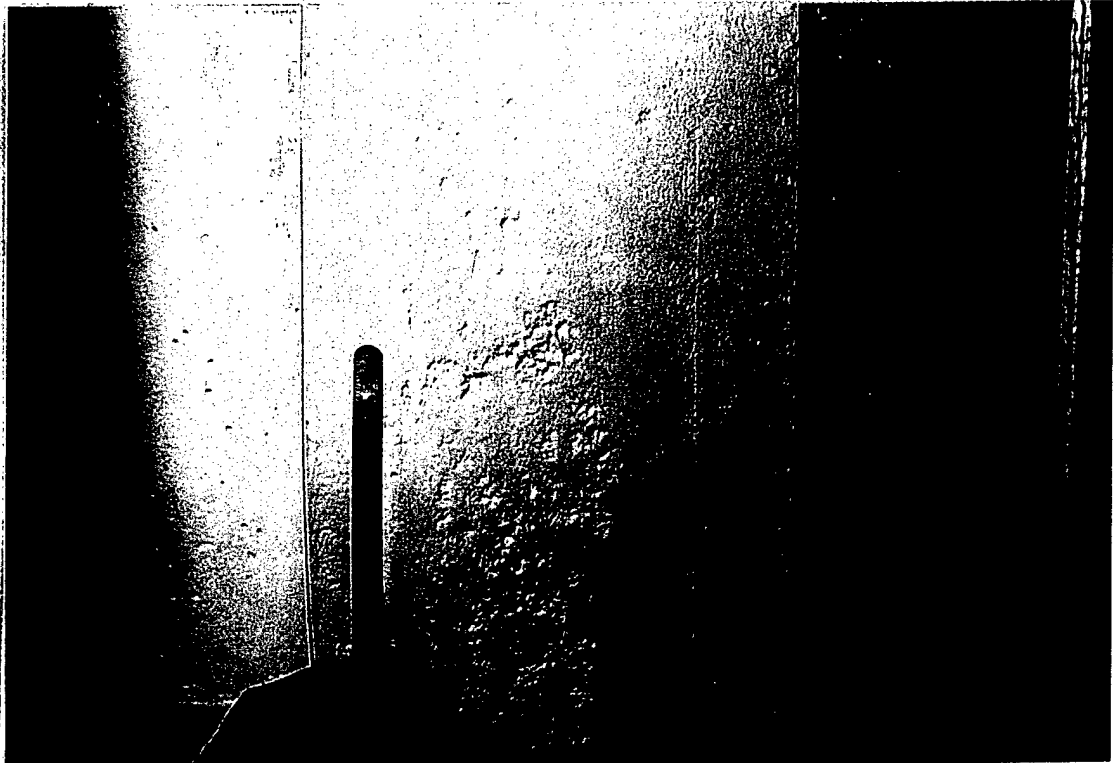


Lower
Granite
Dam

Gate 8
Bottom left corner leak.

10/07/00

8-13

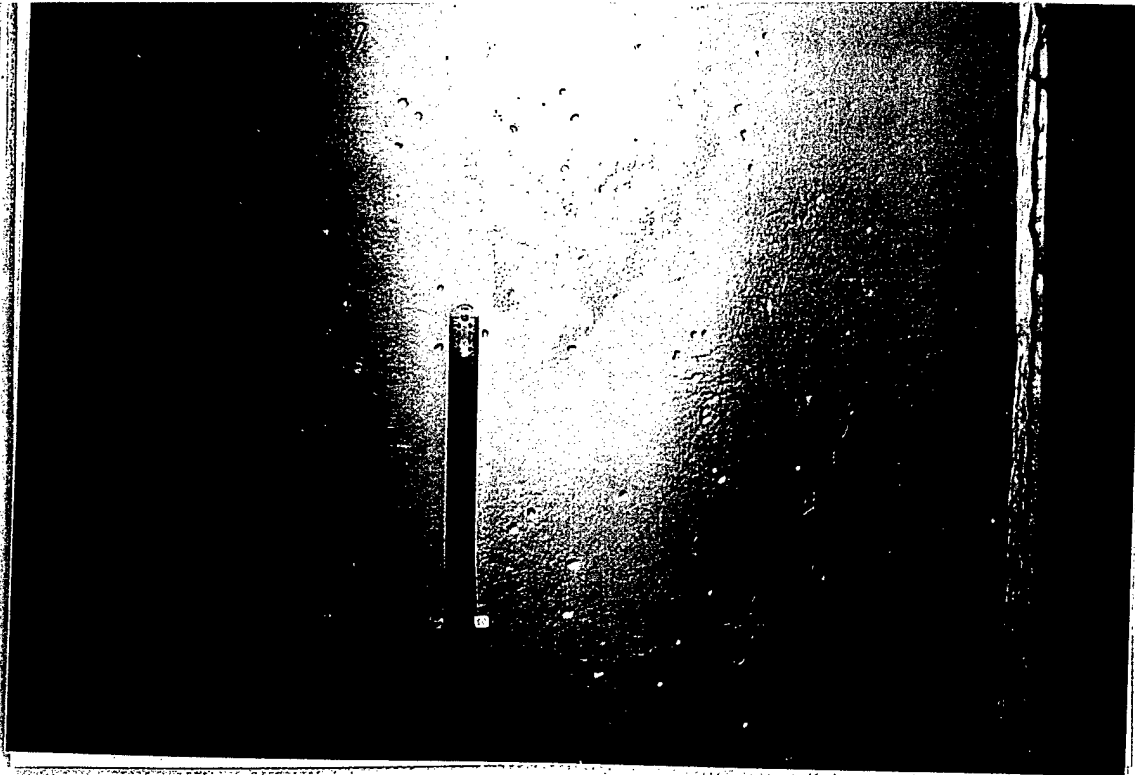


Lower
Granite
Dam

Gate 8
Purlin flange small pitting, typical.

10/07/00

8-14



Lower
Granite
Dam

10/07/00

8-15

Gate 8

Downstream surface of skin plate
pitting, typical.



Lower
Granite
Dam

10/07/00

8-16

Gate 8

Top left radial strut near trunnion.
Light corrosion on top of web
(before scraping).



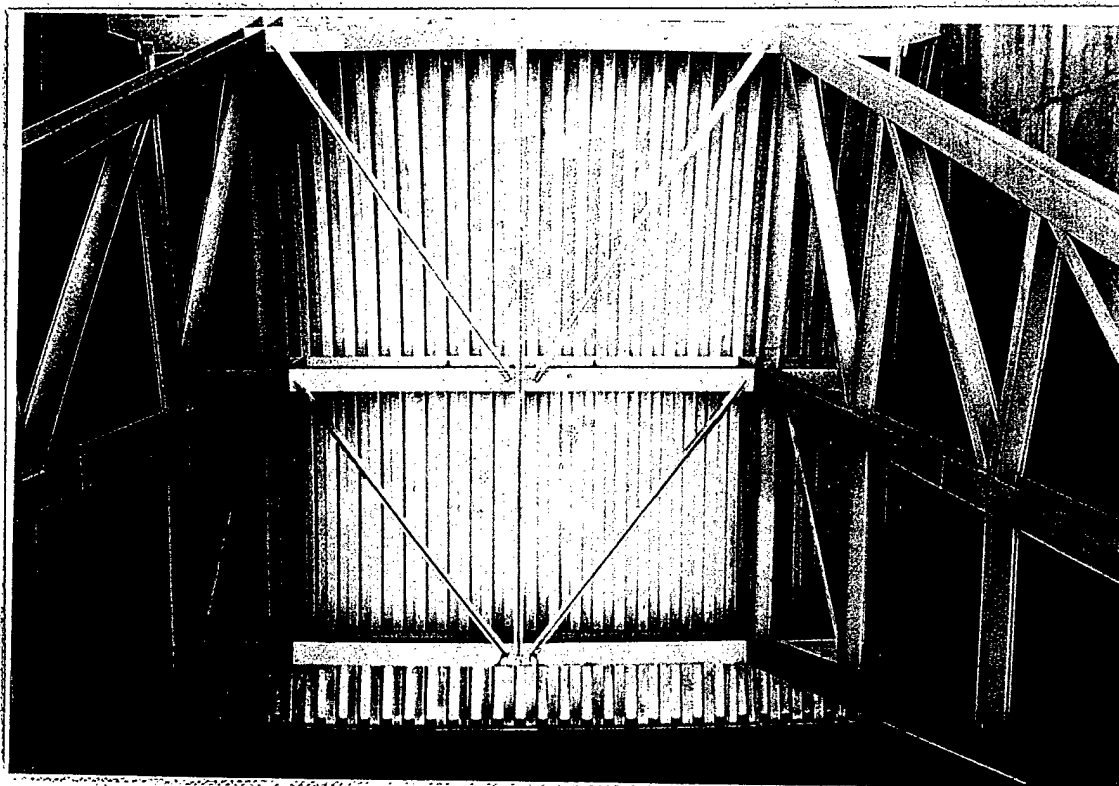
Lower
Granite
Dam

10/07/00

8-17

Gate 8

Top left radial strut near trunnion.
Light corrosion on top of web (after
scraping).



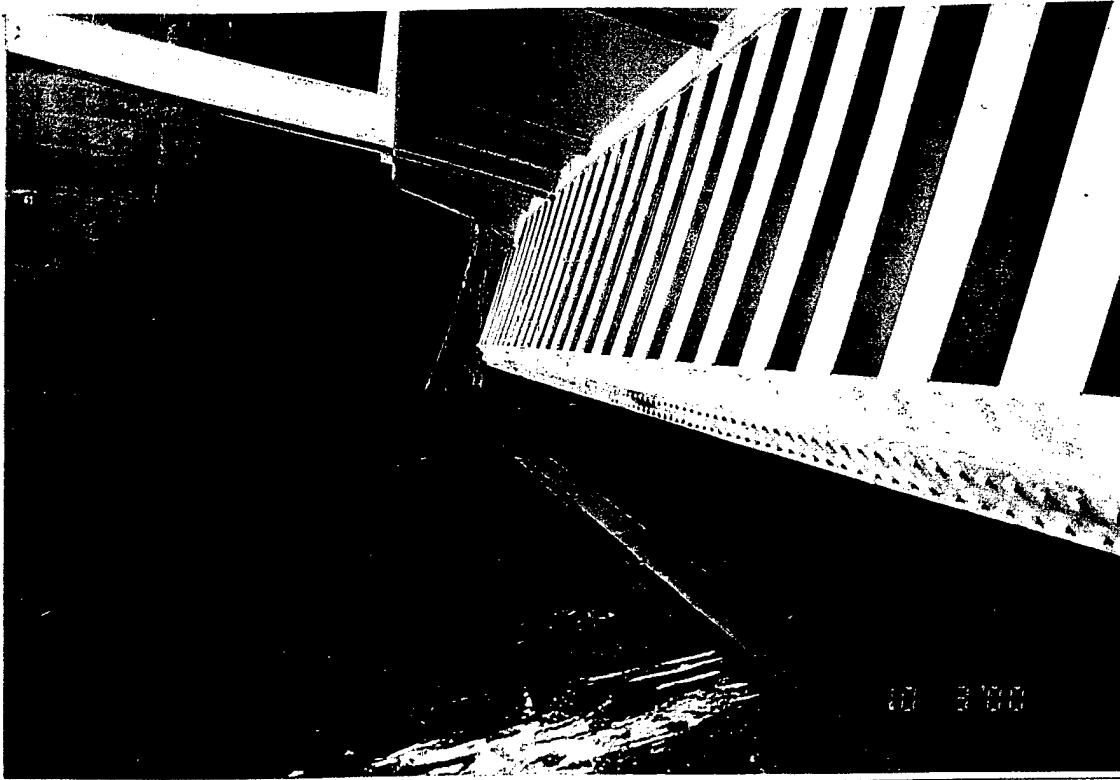
Lower
Granite
Dam

10/07/00

8-18

Gate 8

Gate looking upstream, typical.



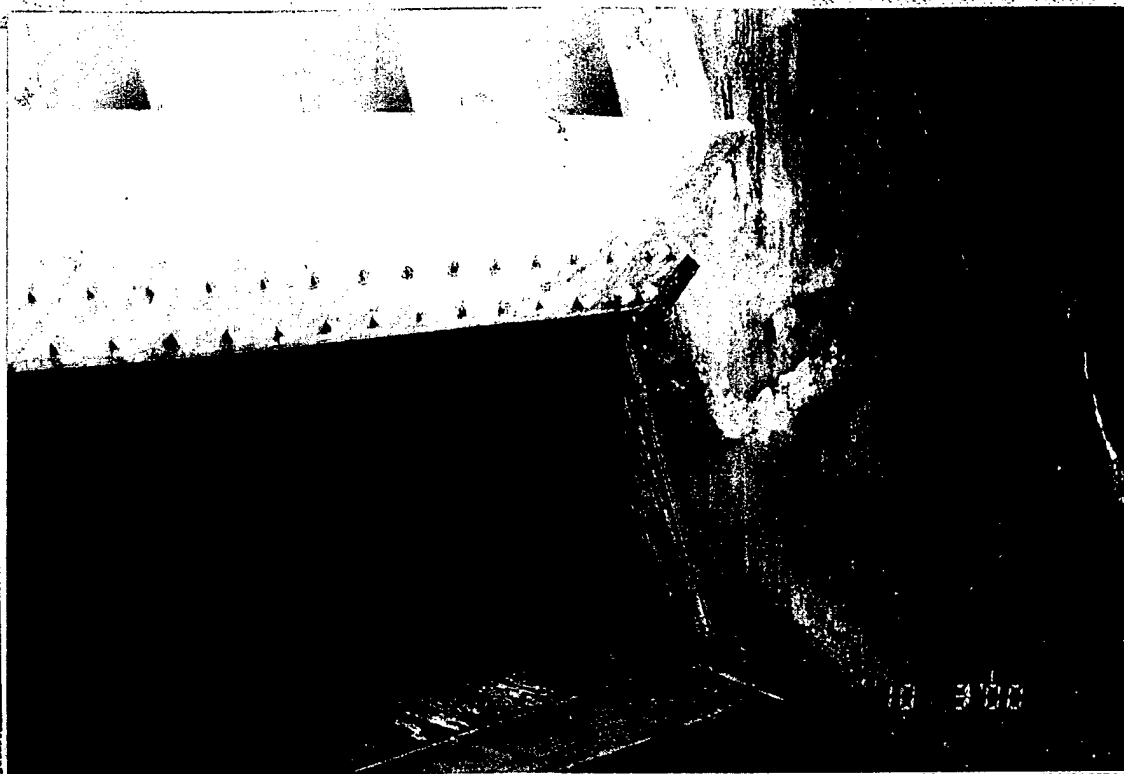
Lower
Granite
Dam

10/03/00

8-19

Gate 8

Embedded bottom seal plate, typical.



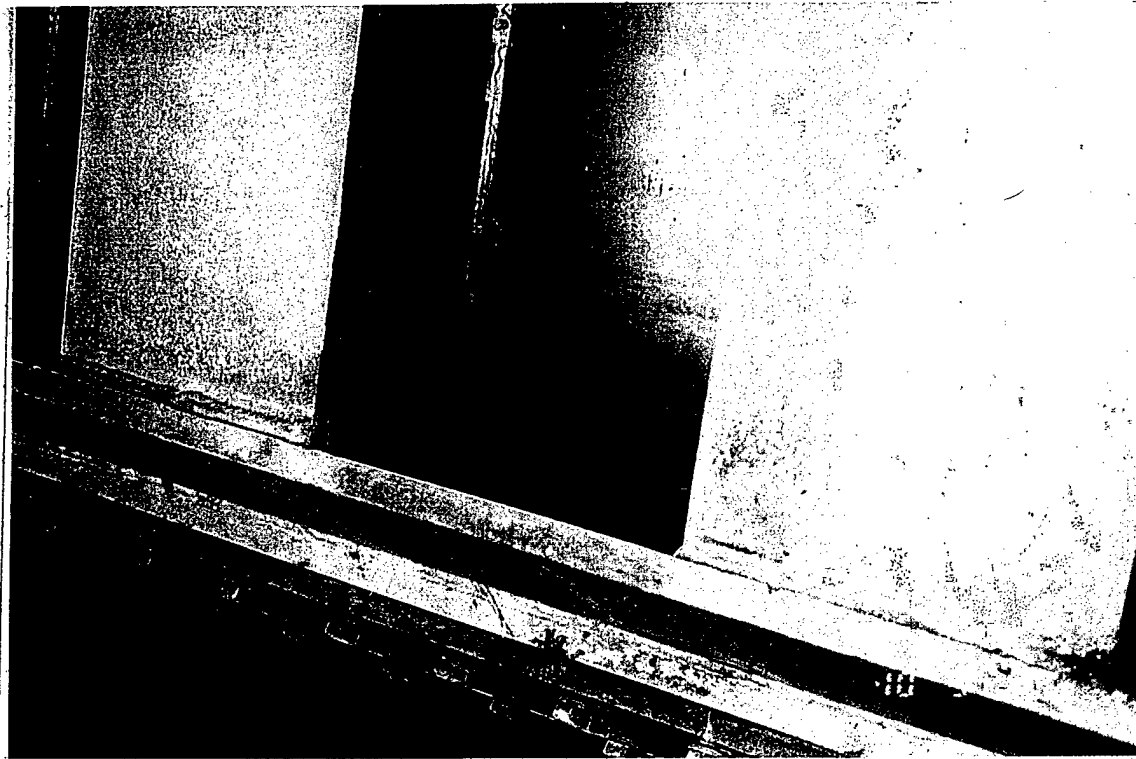
Lower
Granite
Dam

10/03/00

8-20

Gate 8

Bottom left corner of gate.



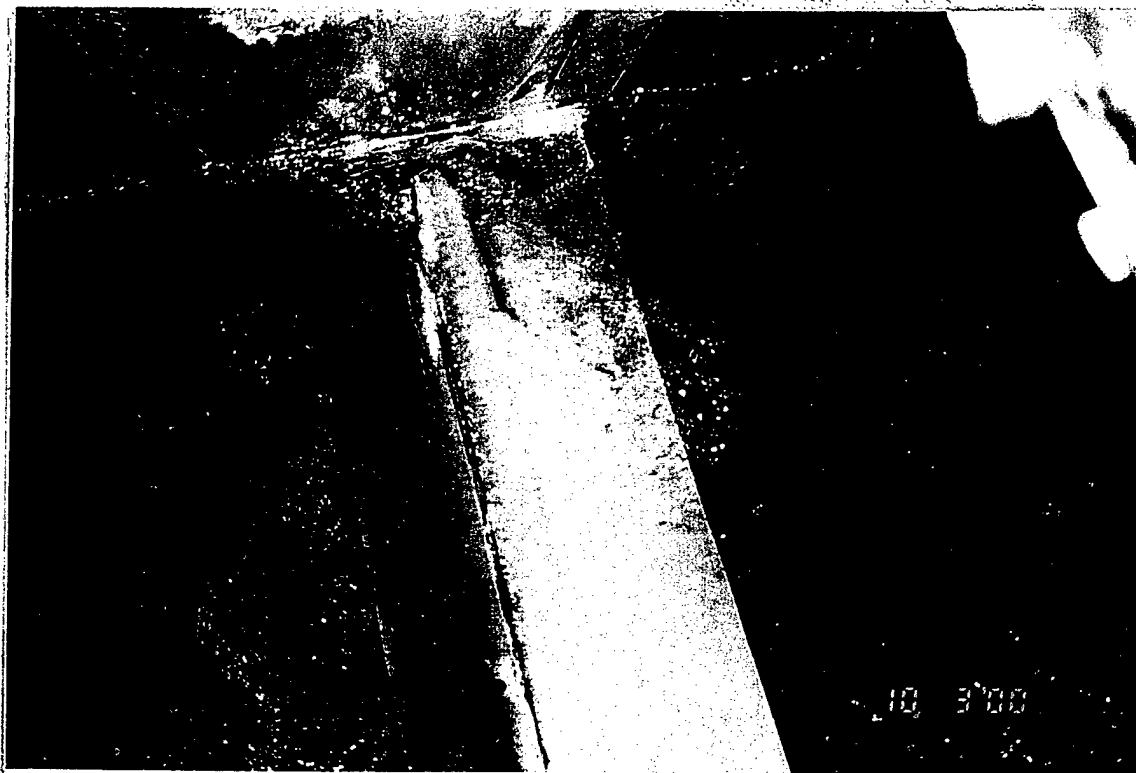
Lower
Granite
Dam

10/03/00

8-21

Gate 8

Bottom seal closure plate looking
upstream. Standing water between
closure plate, purlin webs and
skinplate. Typical.



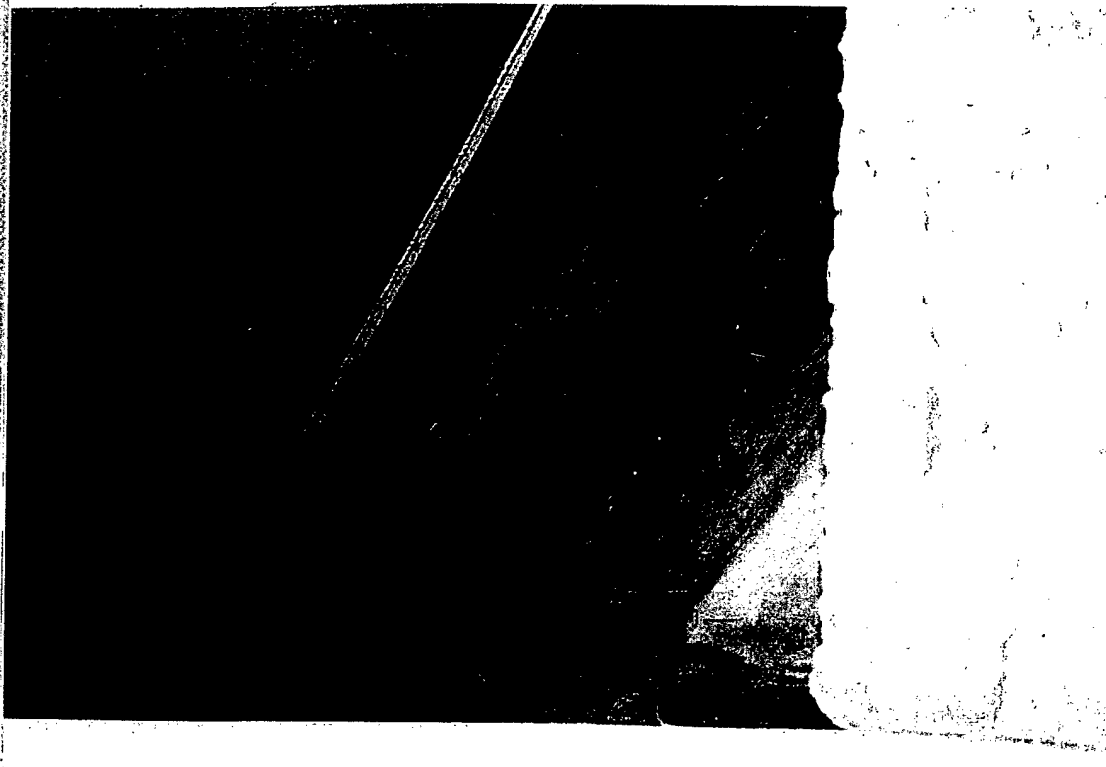
Lower
Granite
Dam

10/03/00

8-22

Gate 8

Embedded bottom seal plate, typical.



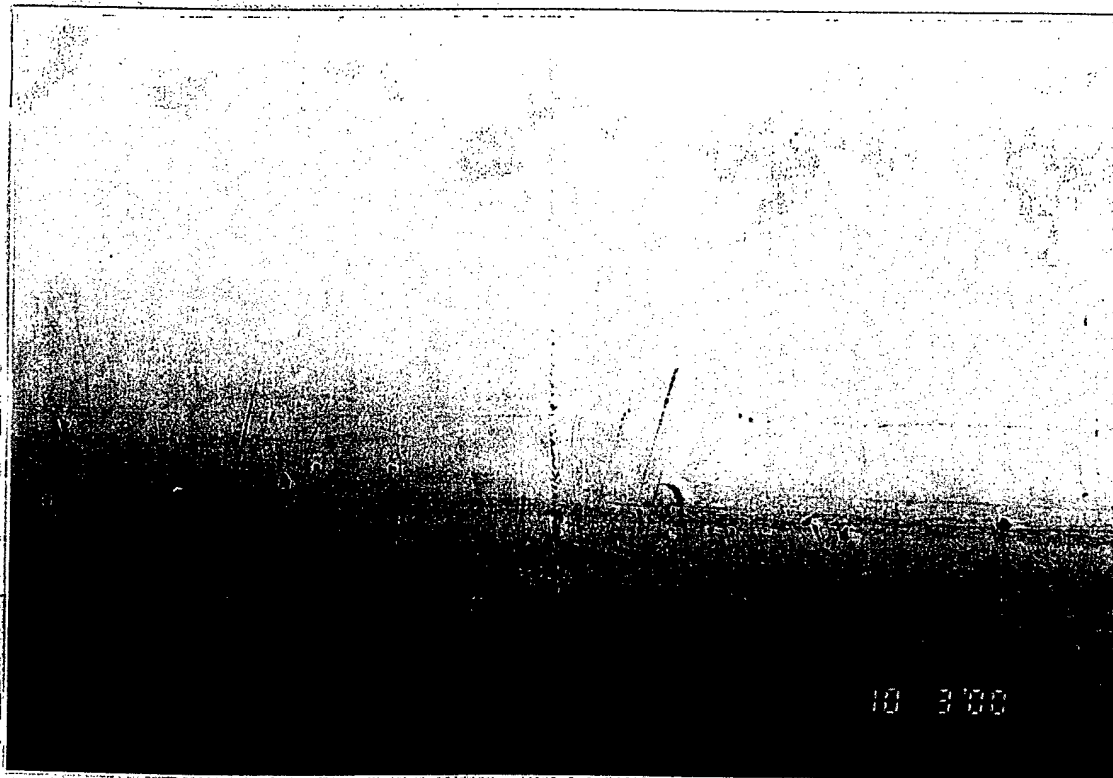
Lower
Granite
Dam

10/03/00

8-23

Gate 8

Upstream surface of skin plate and
wear plate at normal water surface
line.



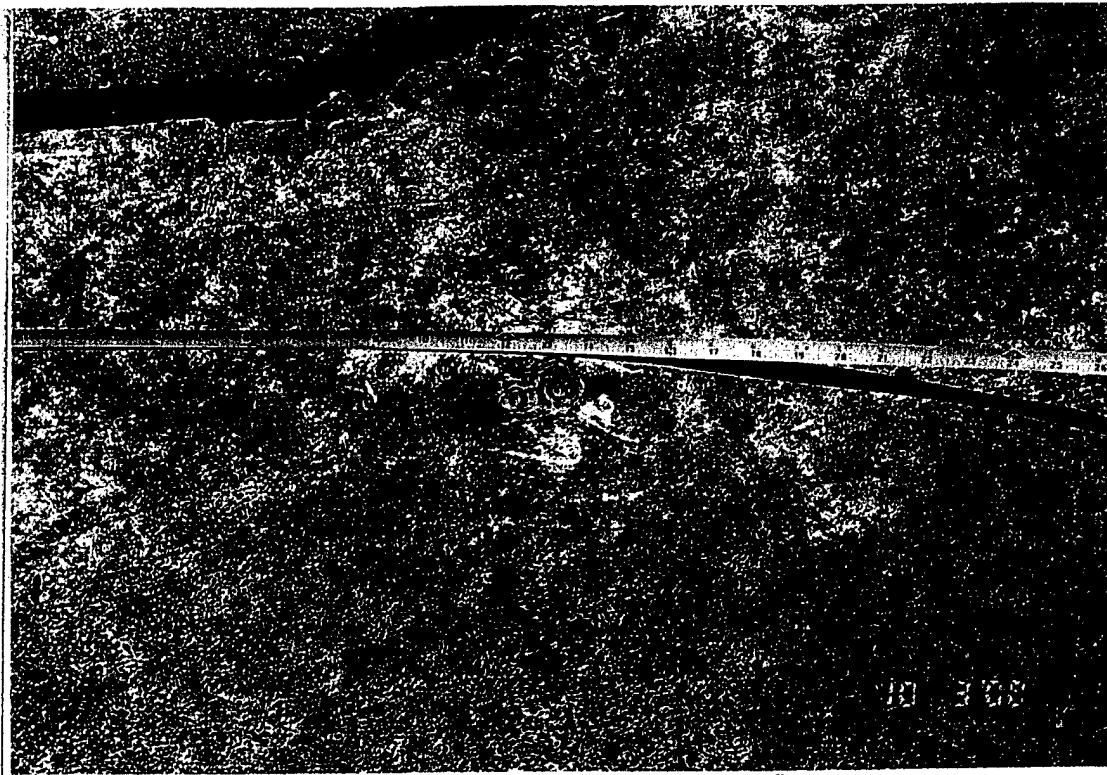
Lower
Granite
Dam

10/03/00

8-24

Gate 8

Close-up upstream surface of skin
plate and wear plate at normal water
surface line. Light pitting, scratches
and scrapes above and below water
surface line.



Lower
Granite
Dam

Gate 8
Skin plate pitting, typical.

10/03/00

8-25

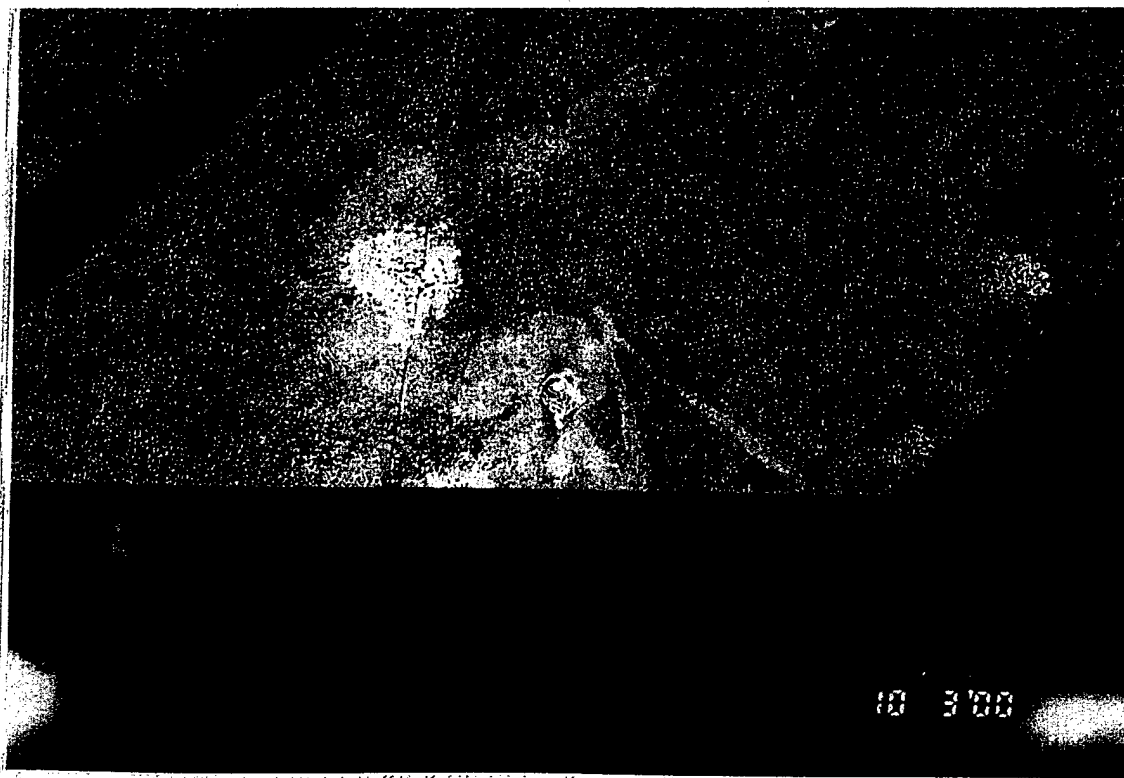


Lower
Granite
Dam

Gate 8
Skin plate pitting near wear plate,
typical.

10/03/00

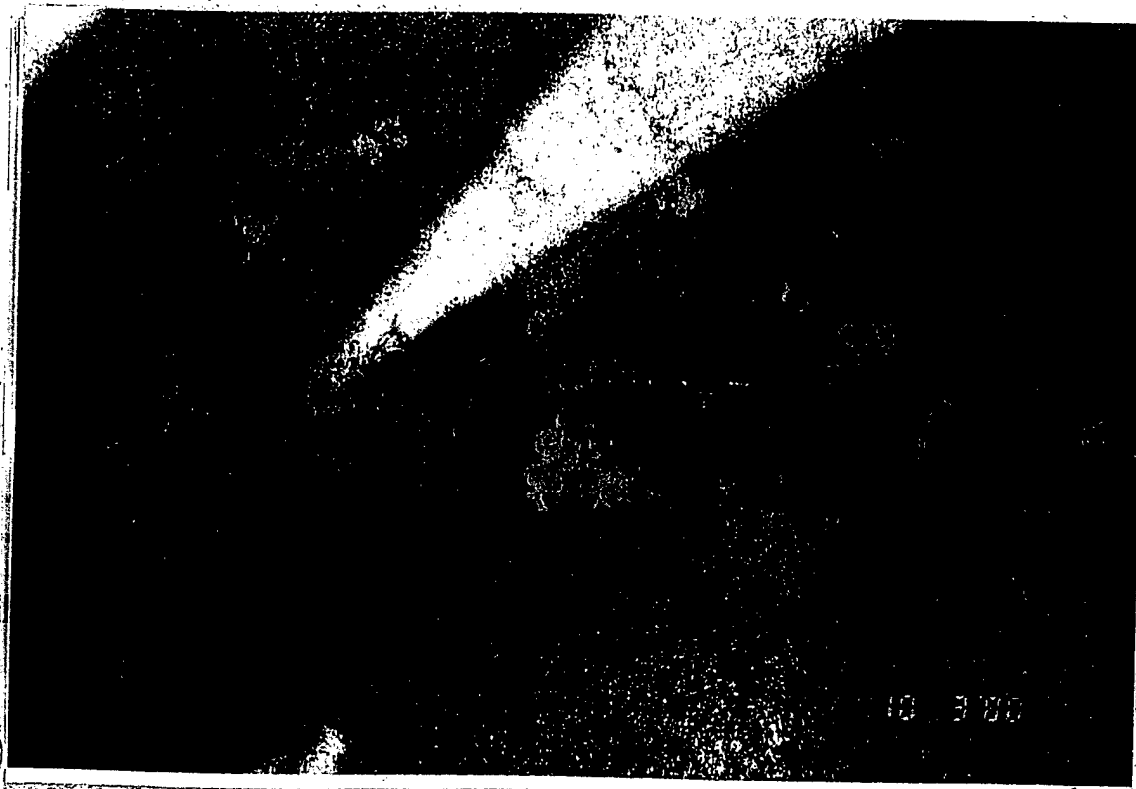
8-26



Lower Gate 8
Granite Skin plate pitting, typical.
Dam

10/03/00

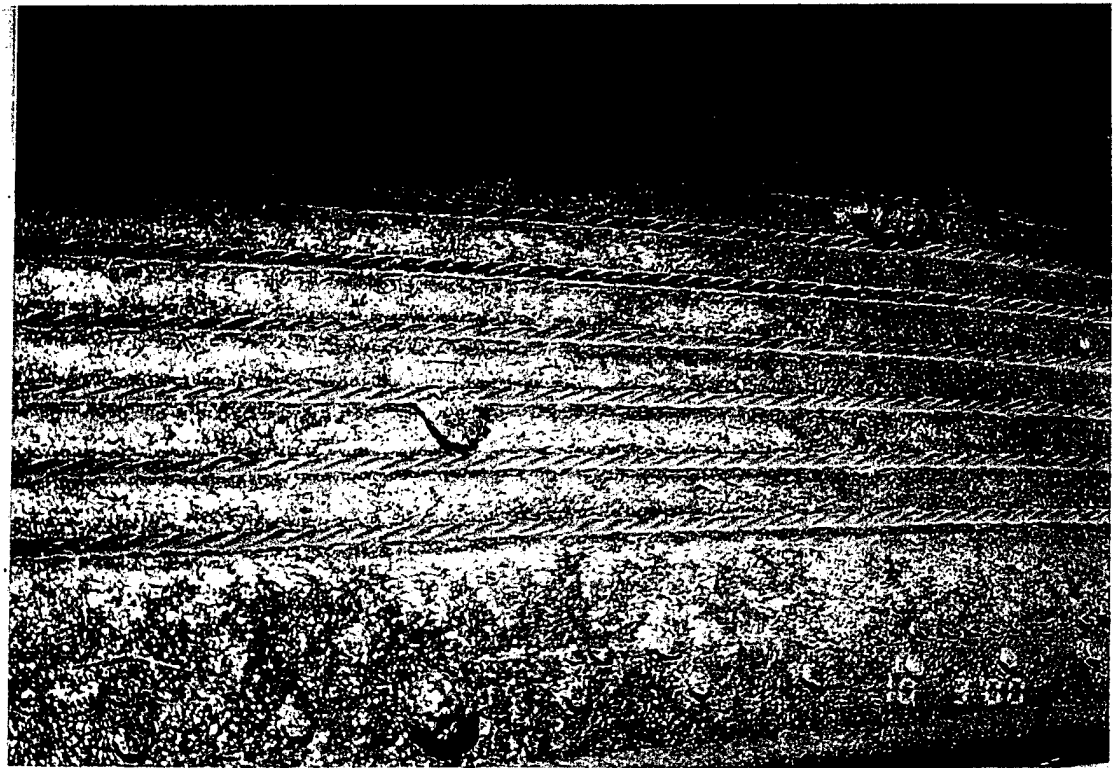
8-27



Lower Gate 8
Granite Skin plate pitting along weld line.
Dam

10/03/00

8-28



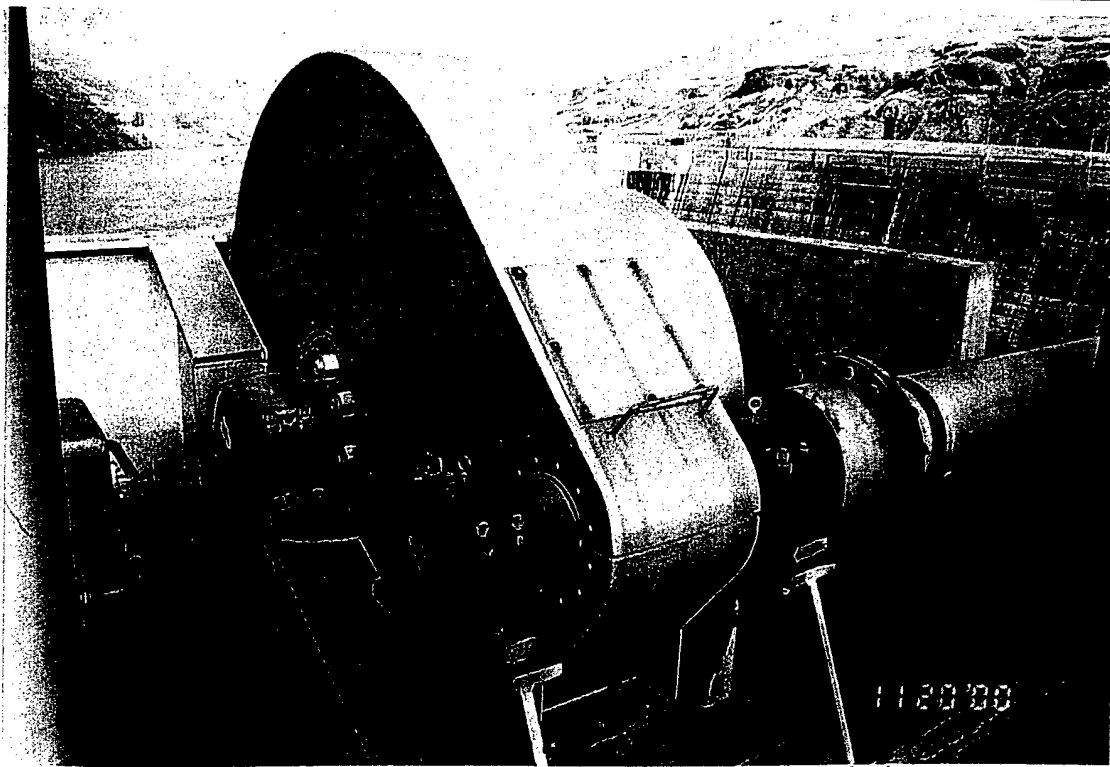
Lower Gate 8
Granite Typical wear plate condition. Light
Dam grooves due to cable wear, light to
10/03/00 moderate corrosion.

8-29



Lower Gate 8
Granite Right hoist connection. Moderate
Dam pitting on lifting lugs and plates.
10/03/00 Stainless steel U-bolts in good
condition.

8-30

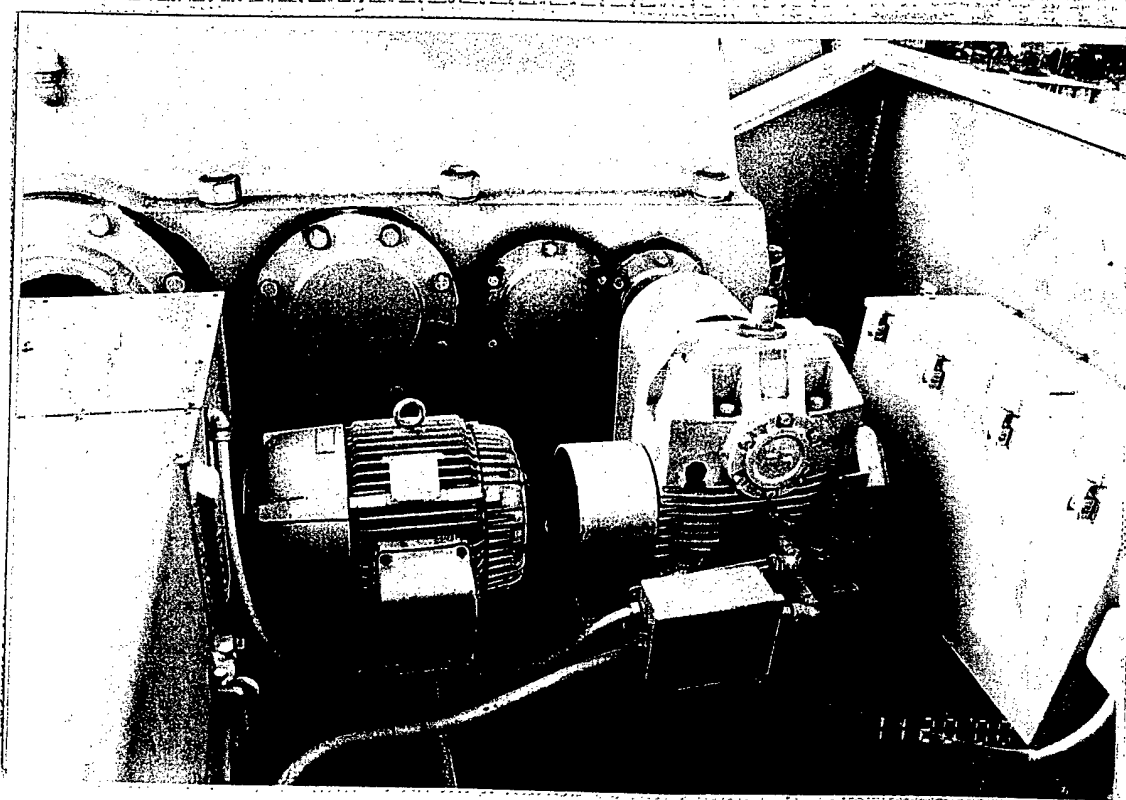


Lower
Granite
Dam

Hoist & Mechanical

Hoist, typical

M-1



Lower
Granite
Dam

Hoist & Mechanical

Hoist motor, typical.

M-2

00.0211

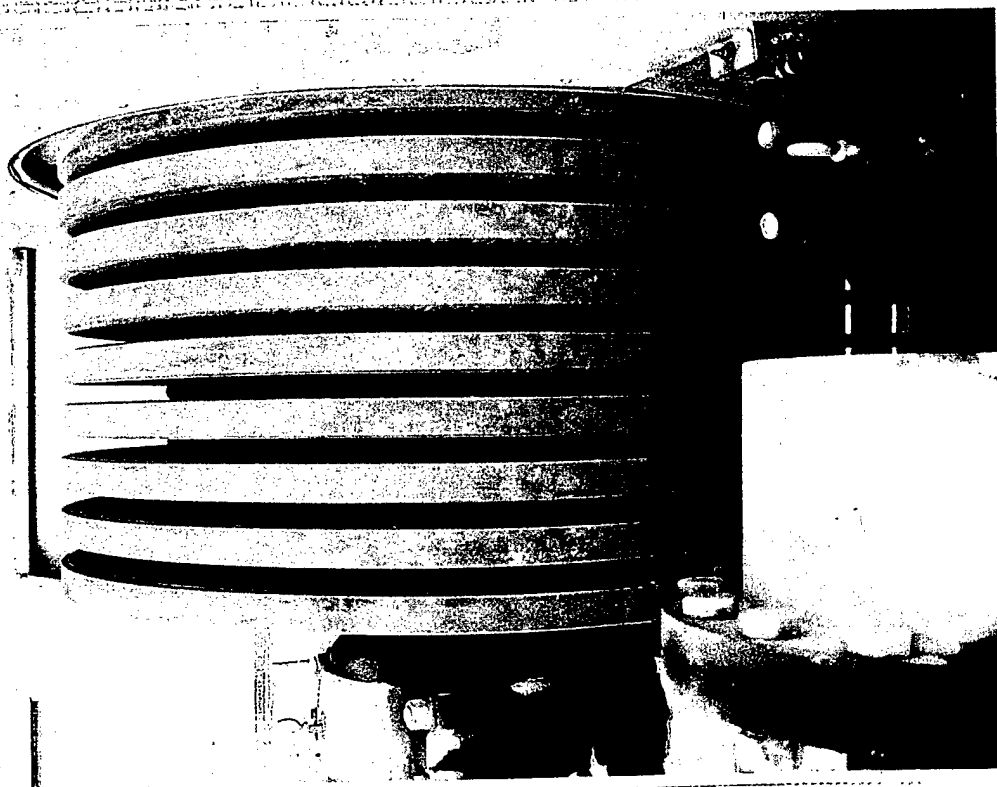


Lower
Granite
Dam

Hoist & Mechanical

Hoist motor name plate, typical.

M-3



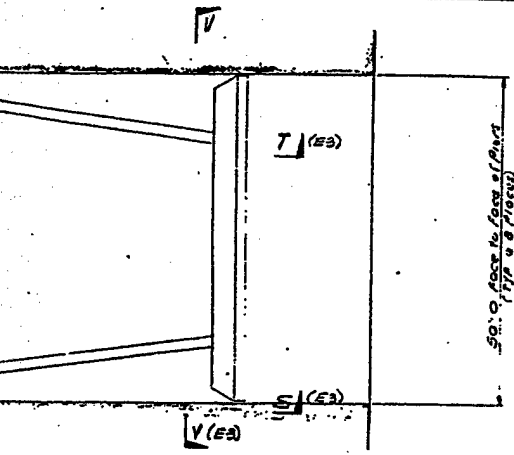
Lower
Granite
Dam

Hoist & Mechanical

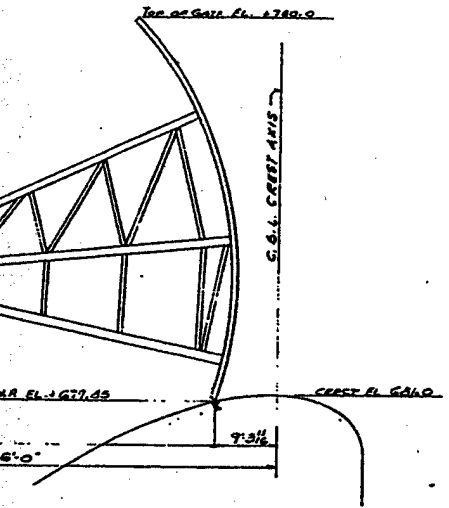
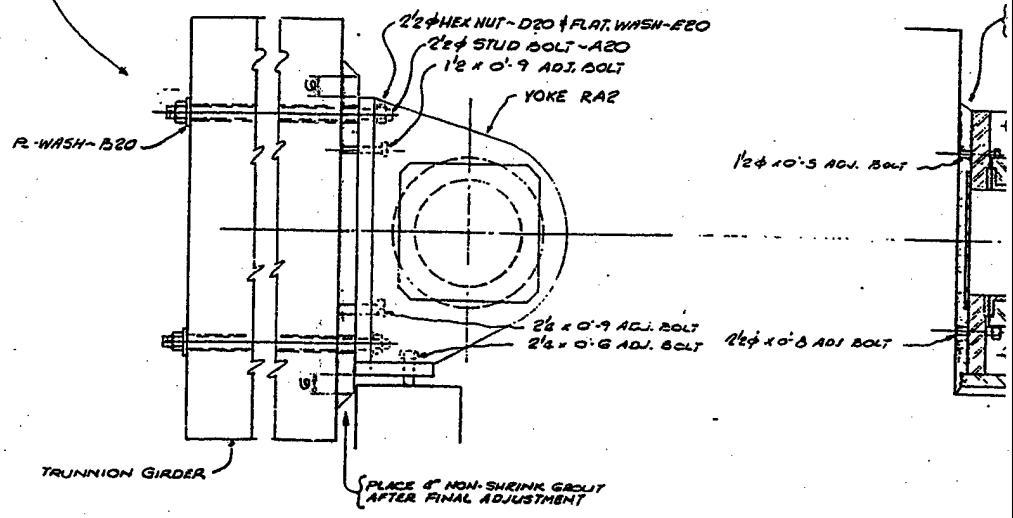
Hoist drum, typical.

M-4

HOLE# _____
 FASTENING _____
 FROM _____



AFTER GROUT HAS BEEN PLACED BEHIND YOKE, TENSION STUDS BY MEANS OF A JACK TO A LOAD OF 80 KIIPS PER STUD. CUT OFF EXCESS STUD & COVER WITH 1" MIN. CONCRETE OVERENDS OF STUDS



L. ARRANGEMENT

NS & DETAILS SEE DWG'S E34E4

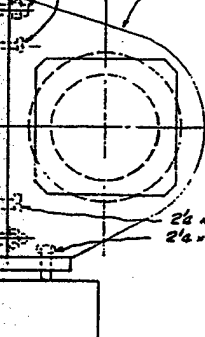
ERECTION NOTE - STRUTS, GIRDERS MUST BE ADEQUATELY PIN-UP CLIPS ARE TO HOLD TOGETHER DURING WELD CARRY THE WEIGHT OF

2

DESIGNER: <u>PC</u> DATE: <u>12/18/10</u> CHECKED BY: <u>AM</u> DATE: <u>12-13-10</u> APPROVED BY: <u>S</u> DATE: <u></u>	
HOLE: <u>UNLESS NOTED</u> FASTENING: <u>UNLESS NOTED</u> FINISH: <u>UNLESS NOTED</u>	NOTES: 1. <u></u> 2. <u></u> 3. <u></u> 4. <u></u> 5. <u></u>

ACED
S
OAD
UT
P WITH
DS

2 1/2" HEX NUT - D20 1/2 FLAT WASH - E20
2 1/2" STUD BOLT - A20
1 1/2" x 6" 9 ADJ. BOLT
YOKE RA2

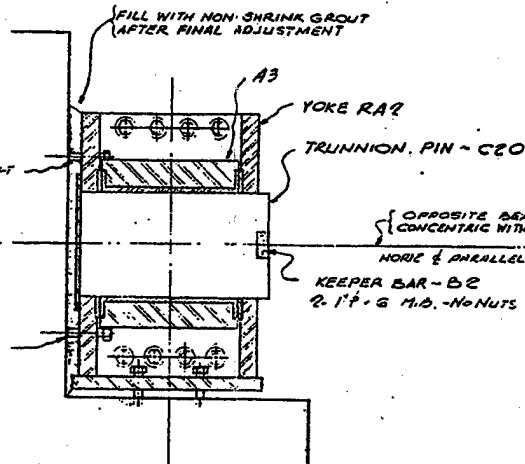


2 1/2" x 6" 9 ADJ. BOLT
2 1/2" x 6" 9 ADJ. BOLT

1 1/2" x 10" 5 ADJ. BOLT

2 1/2" x 10" 5 ADJ. BOLT

FILL WITH NON-SHRINK GROUT
AFTER FINAL ADJUSTMENT



A3

YOKE RA2

TRUNNION PIN - C20

OPPOSITE BEARINGS TO BE
CONCENTRIC WITH $\pm 1/16$ "
HOLE & PARALLEL WITH DRY AXIS

KEEPER BAR - B2
2 1/2" x 6" M.B. - NO NUTS

46" x 2 1/4" 1/2 TRUNNIONS

PLACE 4" NON-SHRINK GROUT
AFTER FINAL ADJUSTMENT

ERECTOR NOTE -
STRUTS, GIRDERS AND SKIN PLATE SECTIONS
MUST BE ADEQUATELY SUPPORTED DURING ERECTION.
PIN-UP CLIPS ARE TO HOLD THE VARIOUS SECTIONS
TOGETHER DURING WELDING AND ARE NOT DESIGNED TO
CARRY THE WEIGHT OF THE MEMBERS.

3

CUSTOMER'S P.O. NO.
CUSTOMER'S DWG. NO.

ISO REFERENCE 182
CONTRACT NUMBER DMCW-65-70-C-0005

APPROVAL STAMP	
APPROVED	
Subject to conditions with plans and specifications. Approval of plans or specifications, and the fulfillment of any material tests, does not constitute an approval of the design or construction of the structure.	
LOWER SHAKA RIVER RESIDENT OFFICE	
23 SEP 1963	

LSR70-0088-132-004

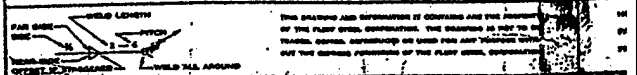
DRAWN BY PC DATE 12/18/60
TRACED BY DATE
CHECKED BY CM DATE 11-11-60
APPROVED BY DATE

STEEL CORPORATION
1528 S. YULSA, OKLAHOMA 74101
ENGINEERING DEPARTMENT

SPILLWAY GATE-BOX ARRANGEMENT
LOWER GRANITE LOCK DAM
LOWER GRANITE CONTR.
BULLMAN, WASH.

70-0544
F2

70-C-88-351



PLANTER IT CONTAINS ARE THE MOST IMPORTANT. THE DRAWING IS ONLY TO BE USED TO LOCATE THE PLANT AREA. THE DRAWING OF THE PLANT AREA, COORDINATES	HOLE: _____ UNLESS NOTED	NOTES	4					DRAWN BY <u>PC</u> DATE <u>11-16-73</u> CHECKED BY _____ APPROVED BY _____ DATE <u>11-23-73</u> SCALE <u>1" = 50'</u>
	PASTURE: _____ UNLESS NOTED		5	1/2" DIA. 1" DIA. 2" DIA. 3" DIA. 4" DIA. 5" DIA. 6" DIA. 7" DIA. 8" DIA. 9" DIA. 10" DIA. 11" DIA. 12" DIA. 13" DIA. 14" DIA. 15" DIA. 16" DIA. 17" DIA. 18" DIA. 19" DIA. 20" DIA. 21" DIA. 22" DIA. 23" DIA. 24" DIA. 25" DIA. 26" DIA. 27" DIA. 28" DIA. 29" DIA. 30" DIA. 31" DIA. 32" DIA. 33" DIA. 34" DIA. 35" DIA. 36" DIA. 37" DIA. 38" DIA. 39" DIA. 40" DIA. 41" DIA. 42" DIA. 43" DIA. 44" DIA. 45" DIA. 46" DIA. 47" DIA. 48" DIA. 49" DIA. 50" DIA. 51" DIA. 52" DIA. 53" DIA. 54" DIA. 55" DIA. 56" DIA. 57" DIA. 58" DIA. 59" DIA. 60" DIA. 61" DIA. 62" DIA. 63" DIA. 64" DIA. 65" DIA. 66" DIA. 67" DIA. 68" DIA. 69" DIA. 70" DIA. 71" DIA. 72" DIA. 73" DIA. 74" DIA. 75" DIA. 76" DIA. 77" DIA. 78" DIA. 79" DIA. 80" DIA. 81" DIA. 82" DIA. 83" DIA. 84" DIA. 85" DIA. 86" DIA. 87" DIA. 88" DIA. 89" DIA. 90" DIA. 91" DIA. 92" DIA. 93" DIA. 94" DIA. 95" DIA. 96" DIA. 97" DIA. 98" DIA. 99" DIA. 100" DIA. 101" DIA. 102" DIA. 103" DIA. 104" DIA. 105" DIA. 106" DIA. 107" 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5 SOUTH FACE
6 OF PIER



END ITEM NUMBER 132
CONTRACT NUMBER ONR-6474-C-0081

APPROVAL SIGNATURE

APPROVED-

Subject to conformity with plans and specifications,
a portion of costs of construction, and to fulfillment of
any required tests. Approval does not cover design or
construction, or responsibility for furnishing and installing.

**"A. LOWER SHAKY RIVER
RESIDENT OFFICE**

Sy *[Signature]*

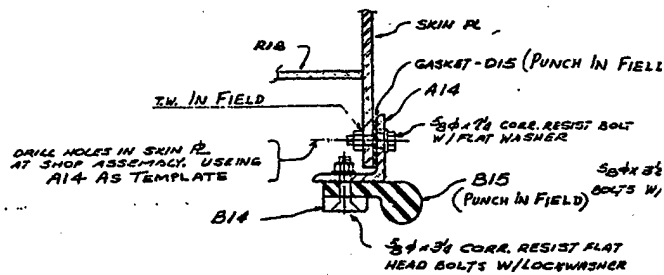
85 SEP 1973

LSR70-0088-132-00

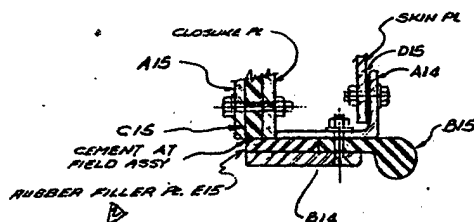
FLINT STEEL CORPORATION

70-C-88-352

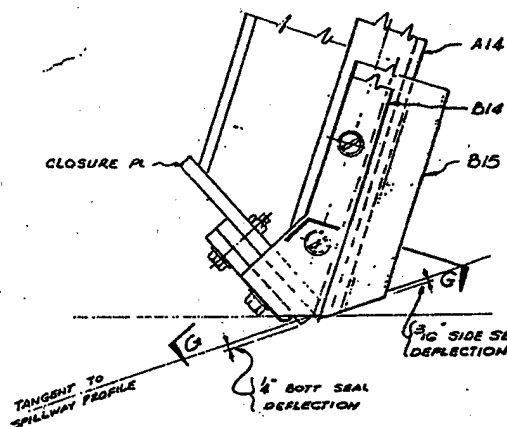
DRILL HOLES IN
AT 3/4"
USE A15 FOR TEM



SECTION C-C - THUS
SECTION X-X-REV.



SECTION G-G



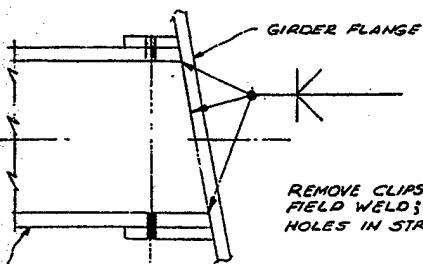
DETAIL "A"

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	

WELD LENGTH
WELD ALL AROUND

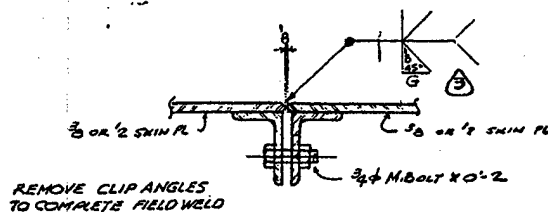
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HOLES
FASTENERS
FINISH

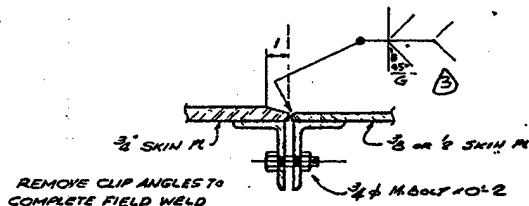


$\frac{3}{4}$ " M.BOLT $\times 0'-6\frac{1}{4}$ (LOWER STRUT)
 $\frac{3}{4}$ " M.BOLT $\times 0'-3\frac{3}{4}$ (CENTER STRUT)
 $\frac{3}{4}$ " M.BOLT $\times 0'-2\frac{3}{4}$ (UPPER STRUT)

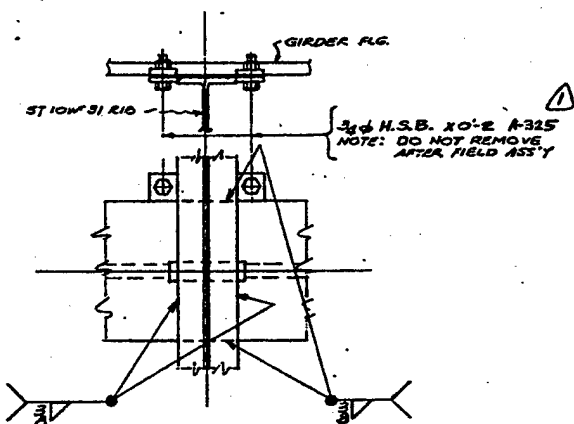
DETAIL "D"
 TYPICAL STRUT TO GIRDER SPLICE



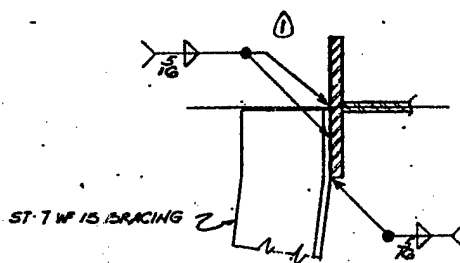
SECTION D-D
 SKIN PL SPLICE



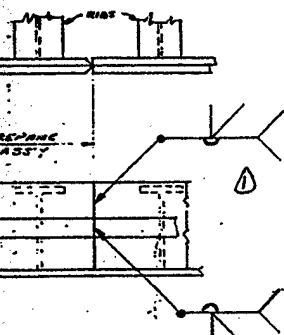
SECTION E-E
 SKIN PL SPLICE



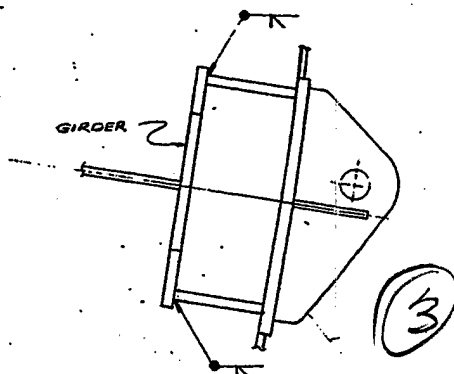
DETAIL "C"
 TYP. RIG TO GIRDER FLG.



SECTION F-F
 TYP BRACING CONN.



DETAIL "G" THUS
 DETAIL "H" REV.
 CLOSED PL & FILLER AN
 FIELD SEALS NOT SHOWN



SECTION K-K

DRAWING NUMBER 132
 CONTRACT NUMBER DASH-23-70-C-0006

APPROVAL STAMPS	
APPROVED I have examined this drawing and find it correct and complete for the work shown. I am not responsible for any errors or omissions in this drawing or for any consequences of its use. LOWER SHAKA RIVER RESIDENT OFFICE 1/25-3/11 Date 22 SEP 1973	

LSR70-0088-132-006

DESIGNED BY	DATE
DRAWN BY	DATE
CHECKED BY	DATE
APPROVED BY	DATE

DESIGNED BY	DATE
DRAWN BY	DATE
CHECKED BY	DATE
APPROVED BY	DATE

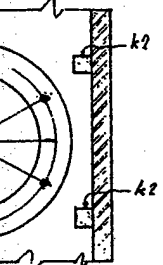
FLINT STEEL CORPORATION
 BOX 1280, TULSA, OKLAHOMA 74101
 ENGINEERING DEPARTMENT

SUGGESTED FIELD DIRECTION
 TOWARD GRANITE LOCK ARRA
 LOWER GRANITE LOCK ARRA
 PULLMAN HALL

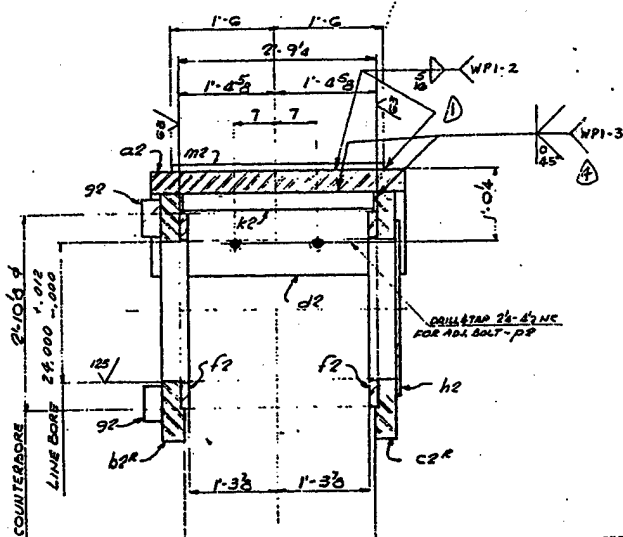
70-0560
 70-C-88-352

HOLES.....
FASTENERS.....
FINISH.....

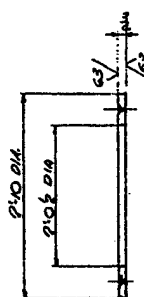
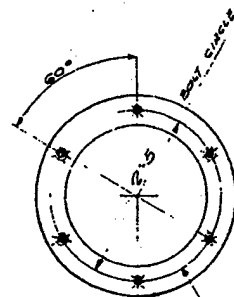
DRILL & TAP 1/2-13 NC x 3 DEEP
TEMPLATE FROM PL F2 (NOT SHOWN)
FOR 1/2 x 3 CRS. BOLTS - 92



- B - THUS
- C - REV



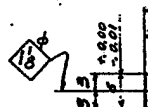
SECTION A-A



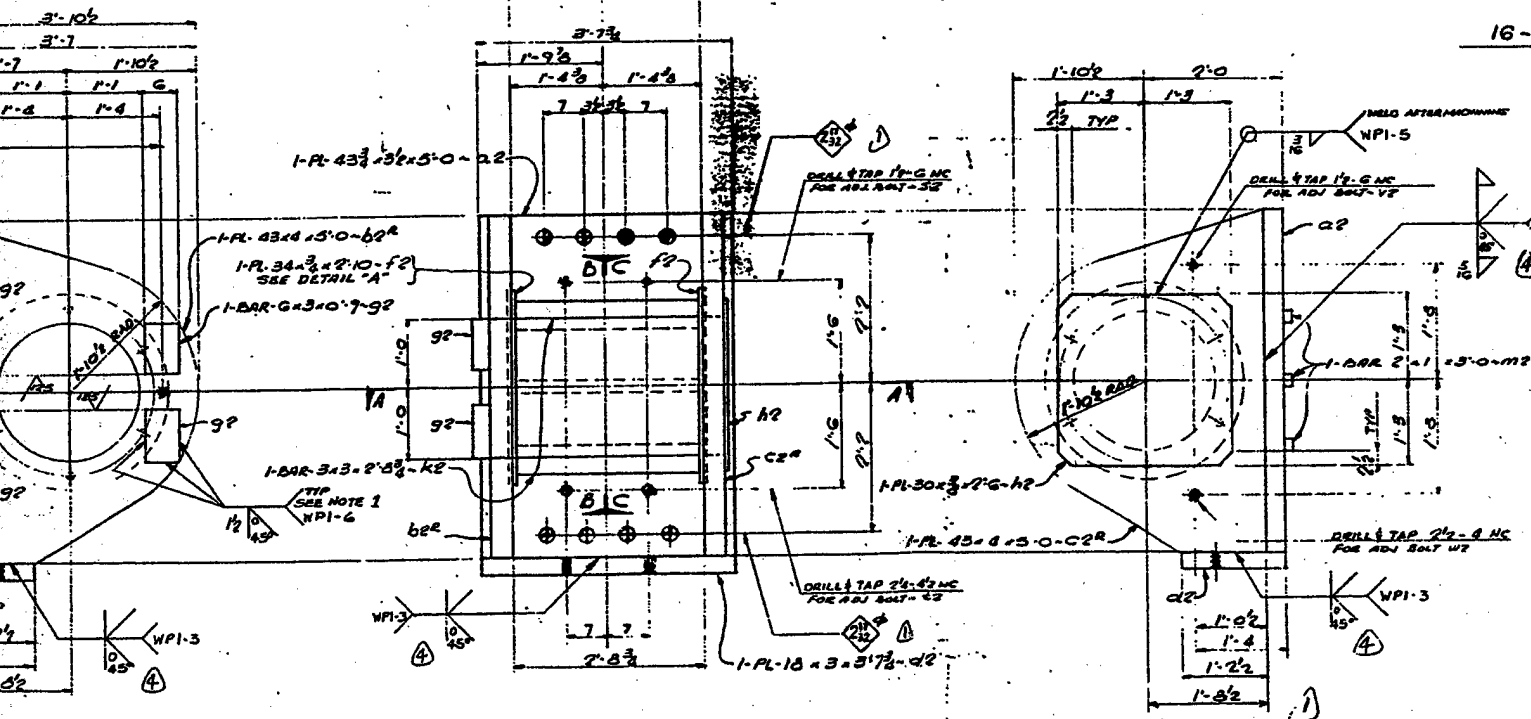
9/16 CTXK. TO GIVE 3/8 IN CL
1/16 BETWEEN HEAD OF BOLT & FACE

DETAIL "A" - THRUST WASHER - F2

CORR. RES. STL. QQ-S-7636, CLASS 300, COND. A



16 -



(2)

8-TRUNNION YOKES - THUS - A2
8-TRUNNION YOKES - REV - RA2

NOTE
TAG ALL MATERIAL
WITH ITEM NO 152

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SYSTEM, WITHOUT PERMISSION IN WRITING FROM THE COMPANY.

HOLDER: _____
FACILITY: _____
FROM: NONE

NOTES

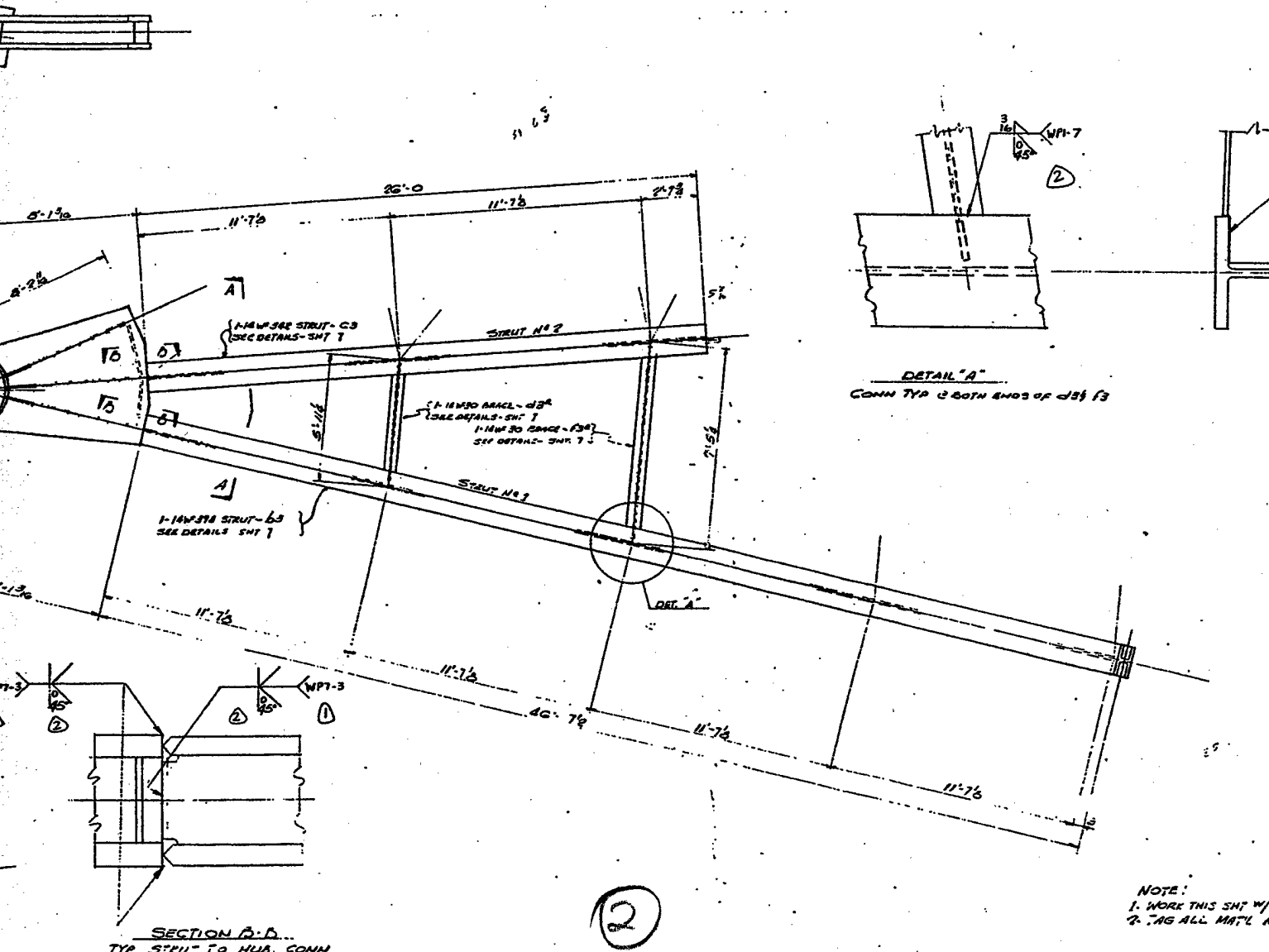
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SYSTEM, WITHOUT PERMISSION IN WRITING FROM THE COMPANY.



* HOLE...
PASTE...
FIBER...



DETAIL "A"
CONN TYP @ BOTH ENDS OF D38 F3

NOTE:
1. WORK THIS SHIP W/
2. AS ALL MATL N.

8- TRUNNION ARM SECTIONS- THIS- A3

8- TRUNNION ARM SECTIONS- REV- RA3

SHOP NOTE

PICTURE IS DRAWN LOOKING AT BOTH ARMS FROM A RIGHT AT THE SAME TIME. EACH ARM IS A TRUE VIEW BUT THEY ARE NOT SHOWN IN A TRUE RELATION TO ONE ANOTHER. THE ARMS ARE TILTED SLIGHTLY TO A PLANE PASSING THRU THEIR & PER SECTION A-A. A LINE PASSING THRU THE WEB ON THE LEFT END THAT IS CUT ON A BEVEL SHOULD BE PERFECTLY HORIZONTAL. ALL DIM. MUST BE WORKED OFF & OF WED DEPTH

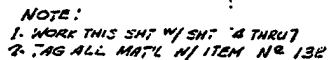
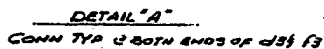
APPROPRIATE TO CONTAIN AND THE PROPERTY
A. COOPERATION. THE DRAWING IS NOT TO BE
REPRODUCED OR USED FOR ANY PURPOSE WITH-
OUT THE WRITTEN PERMISSION OF THE PLANT OPER. DEPARTMENT

HOLES: _____
PATTERNS: _____
FURN: _____

NOTES

REVISED WELD SYMBOLS
A. REV. TYP. APPROV. PRINT DATA Y-10-71
MADE BY: _____
CHECKED BY: _____
DATE: _____

DRAWN BY: PC DATE: 12-2-70
TRACED BY: _____ DATE: _____
CHECKED BY: C.M. DATE: 12-22-70
APPROVED BY: _____ DATE: _____



EACH ARM IS A TRUE VIEW,
ARE TILTED SLIGHTLY TO A
WEB ON THE LEFT END THAT
WORKED OFF $\frac{1}{2}$ OF WEB DEPTH

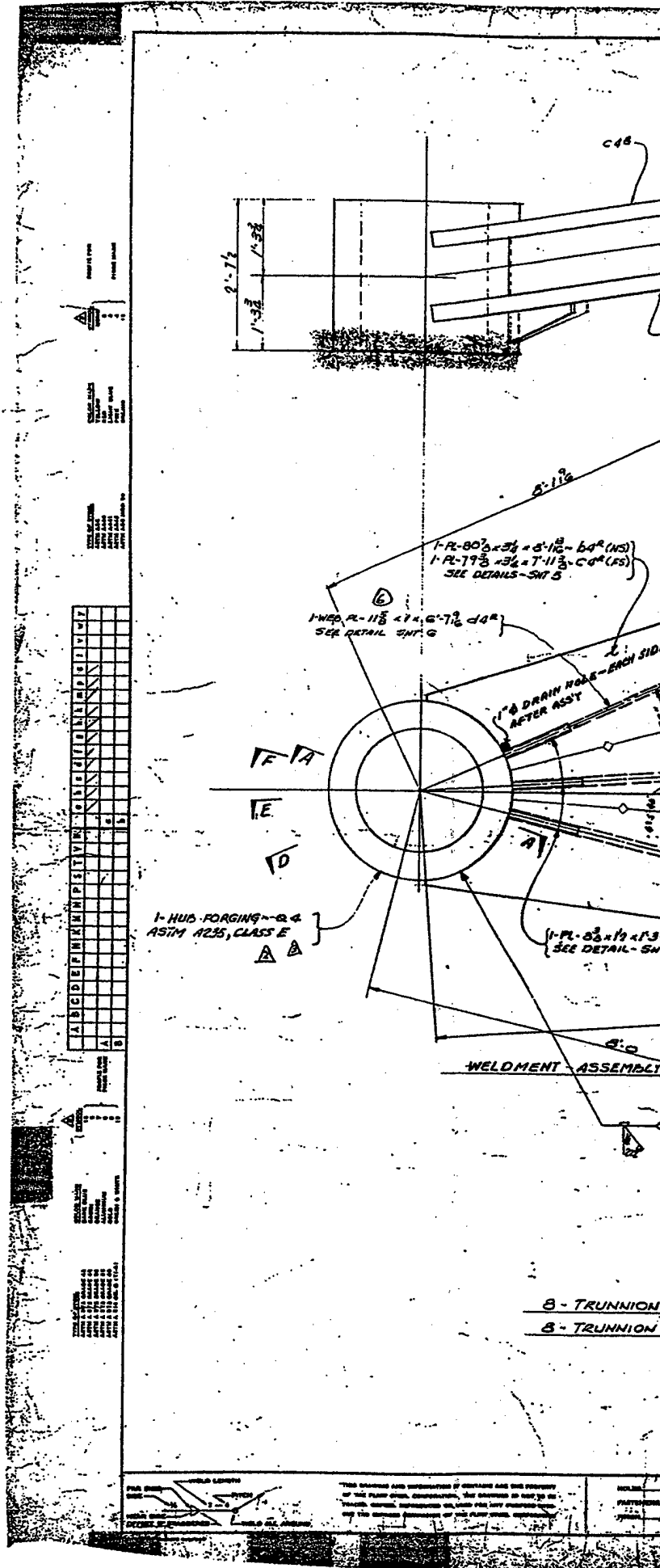
INS ITEM NUMBER 132
CONTRACT NUMBER DACH-68-70-C-0008

25 SEP 1973

LSR 70-0088-132-008

70-C-88-354

1



70-C-88-355

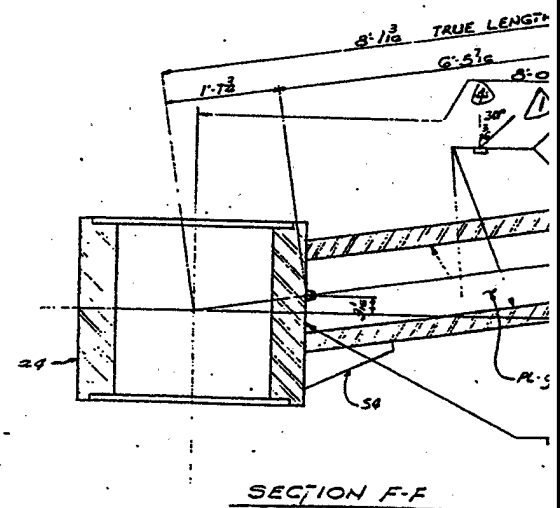
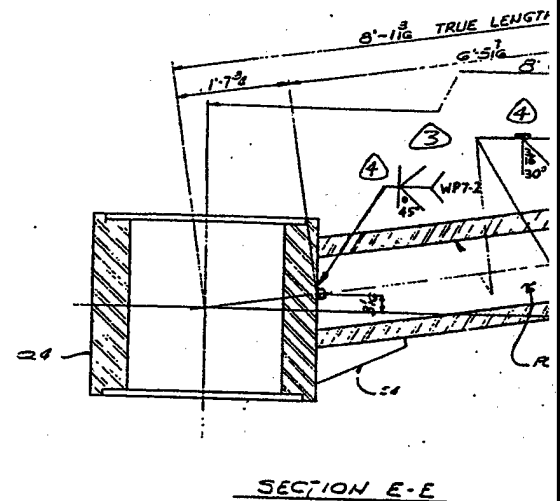
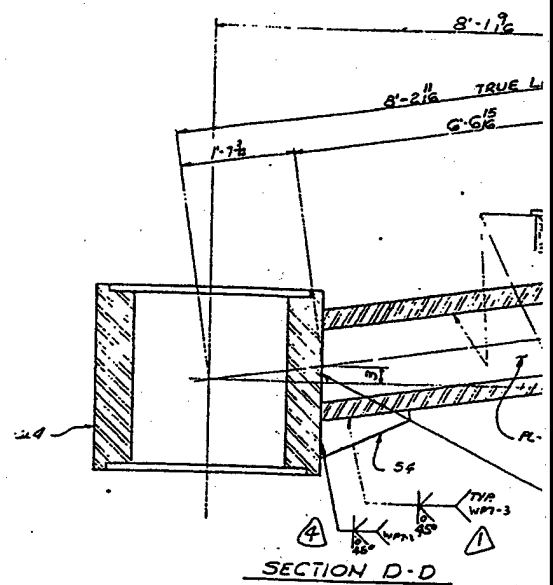
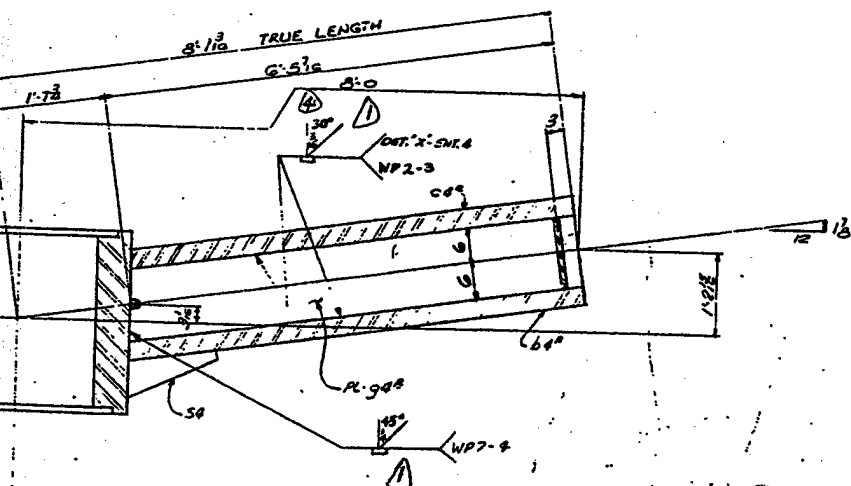
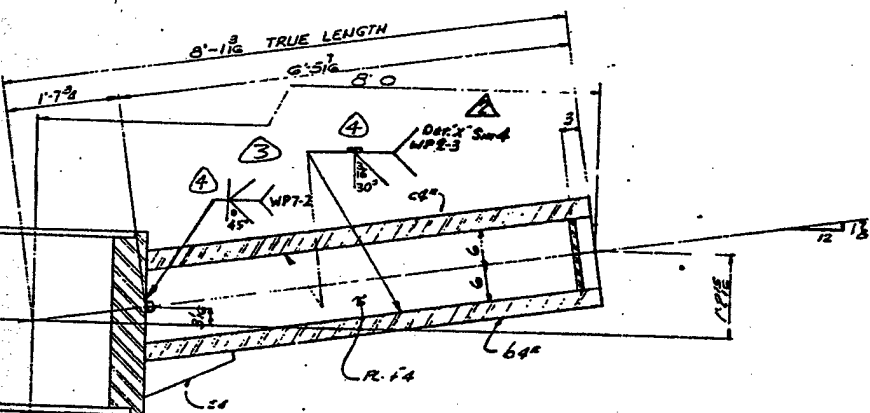
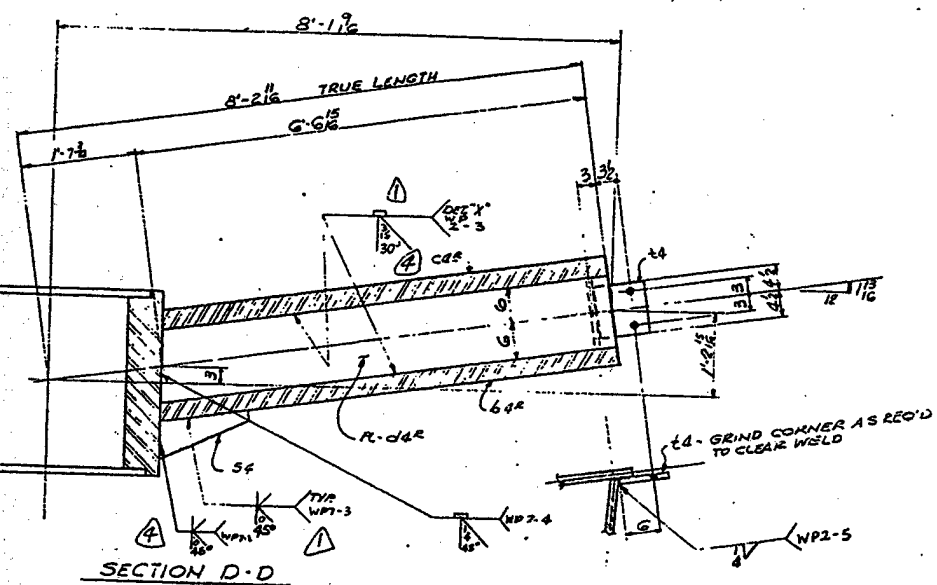
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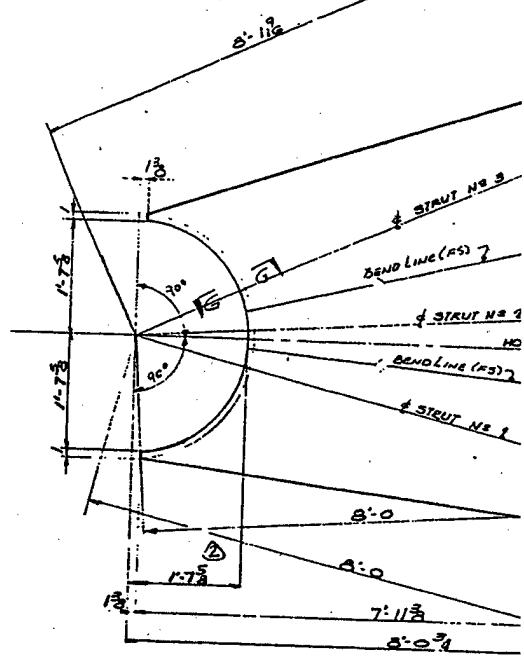
Diagram illustrating a butt joint with labels: FAR SIDE, WELD LENGTH, GROUND, NEAR SIDE, OFFSET, STAGGERED JOINTS, and WELDED ALL AROUND.

THE CHARTS AND INFORMATION IT CONTAINS ARE THE PROPERTY OF THE PLANT OPER, CORPORATION. THE CHARTS IS NOT TO BE LOANED, REPRODUCED OR USED FOR ANY PURPOSE WITHOUT THE EXPRESS PERMISSION OF THE PLANT OPER, CORPORATION

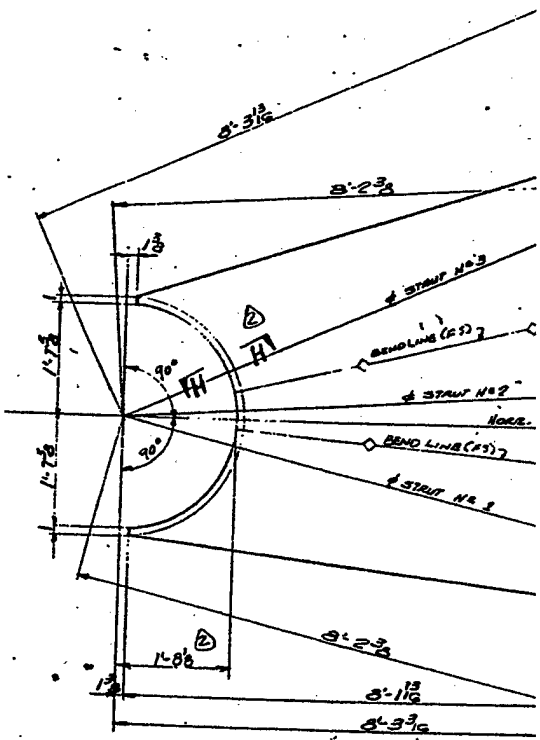
NO. 13
FASTENERS 14
FROM NAI



2



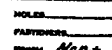
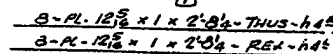
B-R-79 3/4 x 3/4 x 7-11 3/8 - TH
B-R-79 3/4 x 3/4 x 7-11 3/8 - RE

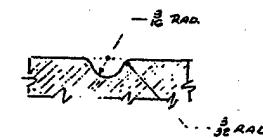
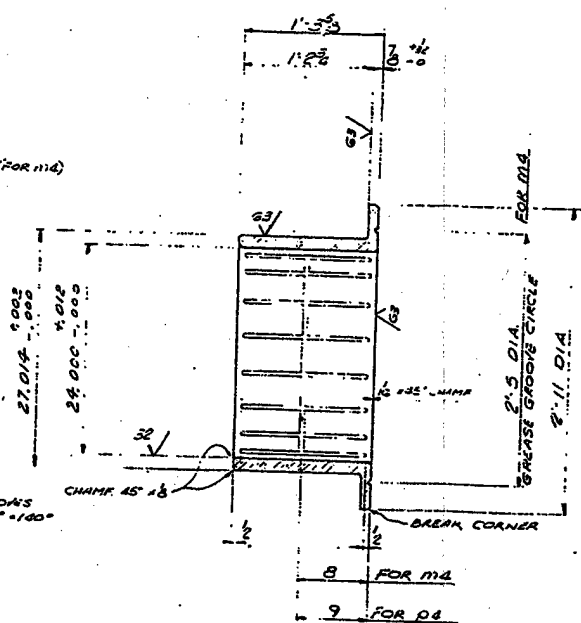
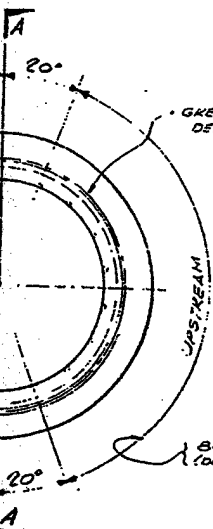


B-R-80 3/4 x 3/4 x 8-1 1/2 - THUS:
B-R-80 3/4 x 3/4 x 8-1 1/2 - REV -

7/24/80 0712Z

AJTM A 078 0610Z 4B
AJTM A 078 0610Z 49
AJTM A 078 0610Z 49
AJTM A 078 0610Z 49
AJTM A 078 0610Z 49
AJTM A 078 0610Z 49
AJTM A 078 0610Z 49



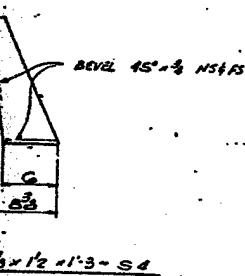


DETAIL "A"
GREASE GROOVE

SECTION A-A

ON BUSHINGS - M4
ON BUSHINGS - P4

ALUMINUM BRONZE
OO-B. GT10 CLASS 3 H.T.
100 CLASS 9-C H.T.



3

CUSTOMER'S P.O. NO.
CUSTOMER'S DRAW. NO.

LSR70-0088-132-011

WORK THIS DWG W/DWG NO. 3-445

DRAWN BY	DATE	12-6-70
TRACED BY	DATE	
CHECKED BY	DATE	12-22-70
APPROVED BY	DATE	

FLINT STEEL CORPORATION
BOX 1200, TULSA, OKLAHOMA 74101
ENGINEERING DEPARTMENT

TERMINATION DETAILS
LOWER GRANITE LOCK & DAM
- LOWER GRANITE CENTER
- FULLMAN, NASH

70-0540
6

DWG ITEM NUMBER 132
CONTRACT NUMBER DAW-68-70-C-0008

APPROVAL STAMPS

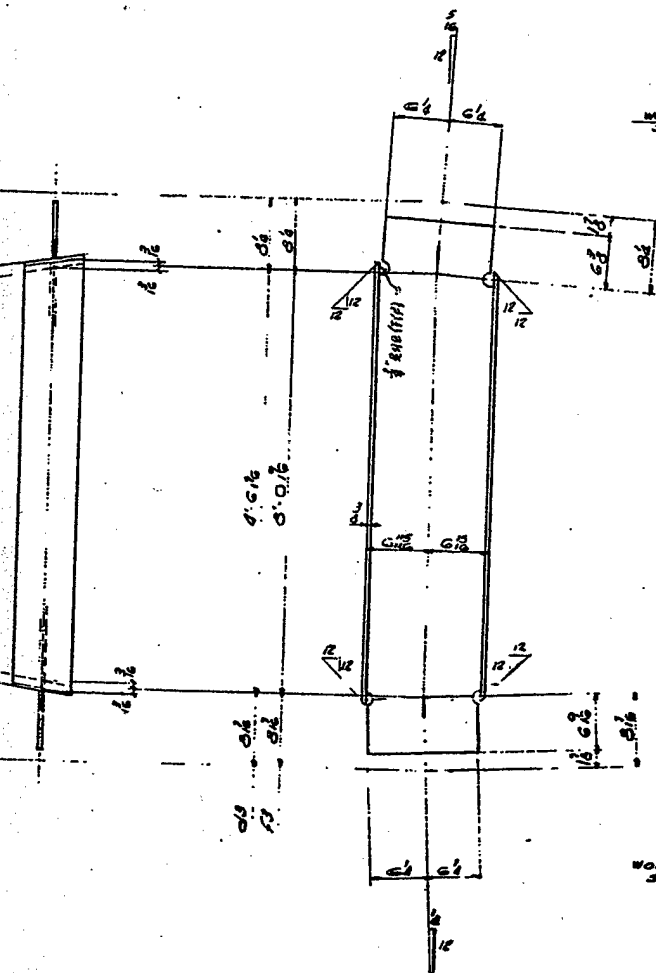
APPROVED

Subscribed to uniformly with plans and specifications, conditions of contract, and in full payment of any money then due and not yet paid at the time of execution of this agreement.

LOWER SHAKA RIVER
RESIDENT OFFICE

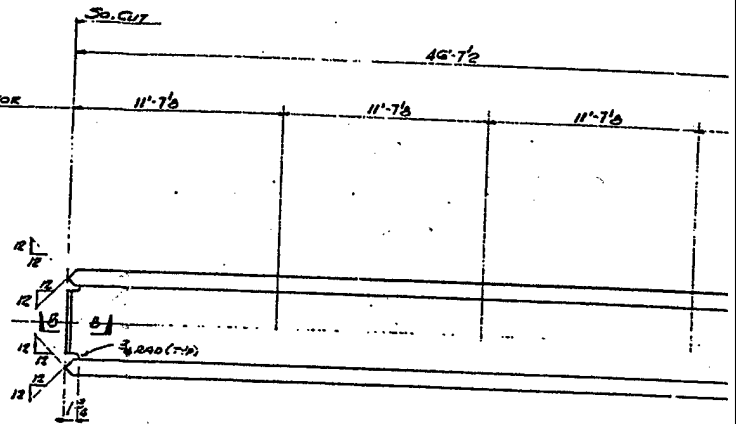
23 SEP 1970

70-C-88-357



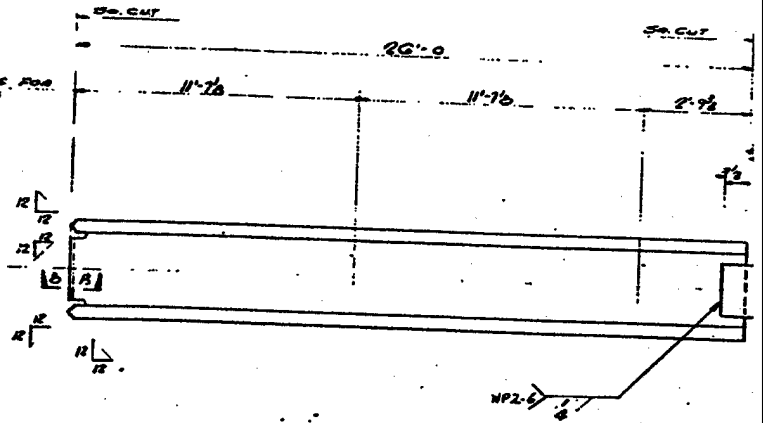
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 2. 12' 0" x 12' 0" - REV. 12' 0"
 3. 12' 0" x 12' 0" - THIS IS NOTED - 12' 0"
 4. 12' 0" x 12' 0" - REV. 12' 0"

WORK POINT DIMS FOR
STRUT BRACING

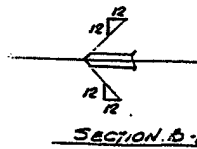


1G-STRUTS - 14 W 398 x 46' 0" - 63

WORK POINT DIMS FOR
STRUT BRACING



1G-STRUTS - 14 W 342 x 26' 0" - 63

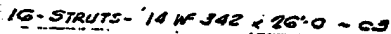
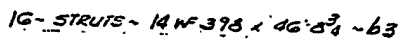


SECTION B-B

1- WCA
 2- THIS
 3- TAG

2

THIS AND INFORMATION IS CONTAINED AND THE PROPERTY OF THE COMPANY. THE DRAWING IS NOT TO BE REPRODUCED OR USED FOR ANY PURPOSES OTHER THAN THE ORIGINAL PURPOSE OF THE DRAWING.		NOTES 1. 12' 0" x 12' 0" - THIS IS NOTED - 12' 0" 2. 12' 0" x 12' 0" - REV. 12' 0" 3. 12' 0" x 12' 0" - THIS IS NOTED - 12' 0" 4. 12' 0" x 12' 0" - REV. 12' 0"		1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100		DRAWN BY: PC DATE: 12-12-10 TRACED BY: DATE: 12-12-10 CHECKED BY: C.M. DATE: 12-12-10 APPROVED BY: DATE:	
--	--	---	--	--	--	---	--



1- WORK THIS SHT W/ SHT N# 3
2- THIS SHT DETAIL MAT'L - DO NOT SHIP
3- TAG ALL MAT'L W/ ITEM N# 132

CONTRACT NUMBER *DYCW-68-70-C-0088*

Subject to conformity with plans and specifications
of member of union or association and to full and
complete satisfaction of the member of the
association or association by the assembling and forwarding
LOWER SNAKE RIVER
RESIDENT OFFICE
25 SEP 1973

LSR 70-0088-132-012

FLINT STEEL CORPORATION
BOX 1288, TULSA, OKLAHOMA 74104
ENGINEERING DEPARTMENT

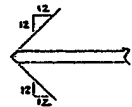
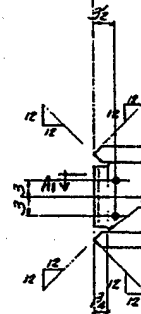
STRUT & BRACE DETAILS
LOWER GRANITE LOCK & DAM
to LOWER GRANITE CONTR.
PULLMAN, WASH.

JOB NO.
78-0549
SHEET NO
7

70-C-88-358

MATCH MARK W/C3 (SHT#7)
FOR CUTTING
WORK POINT DIMS FOR
STRUT BRACING

20'-7 1/2" (14 W 348 x 20'-8 3/4")
8'-9 3/8" 11'-7 1/2"

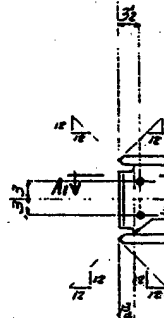


SECTION A1-A1

16- STRUTS- AB

WORK POINT DIMS. FOR
STRUT BRACING

47'-4 1/2" (11'-8 3/8" 11'-9 1/8"



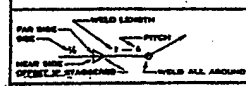
16- 5

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z



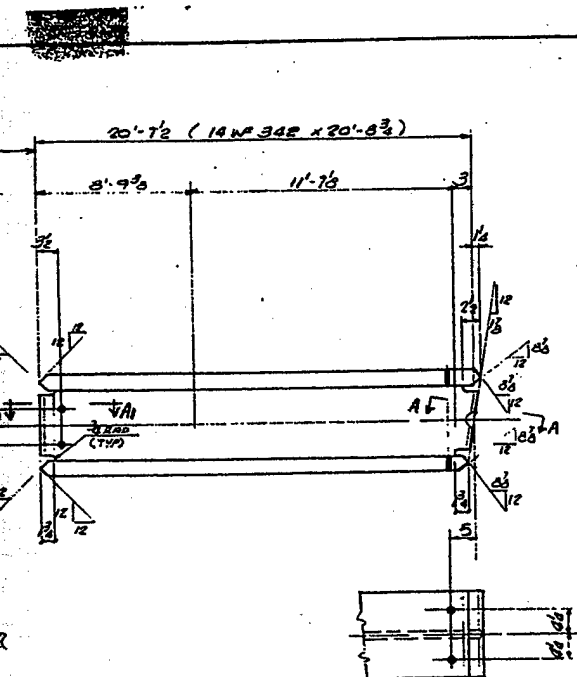
SECTION A1-A1

WELD ALL AROUND

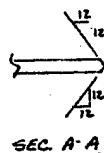


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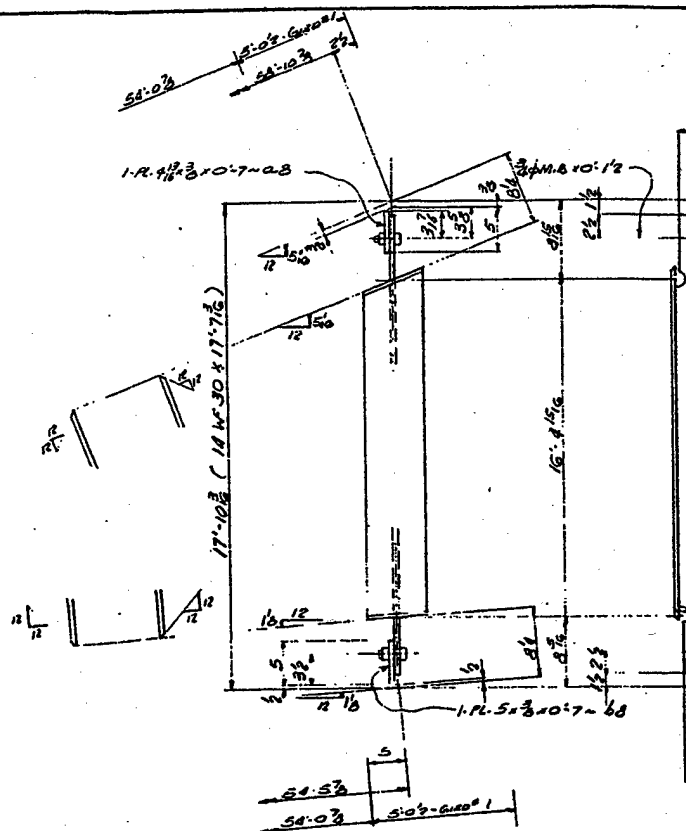
16- 5



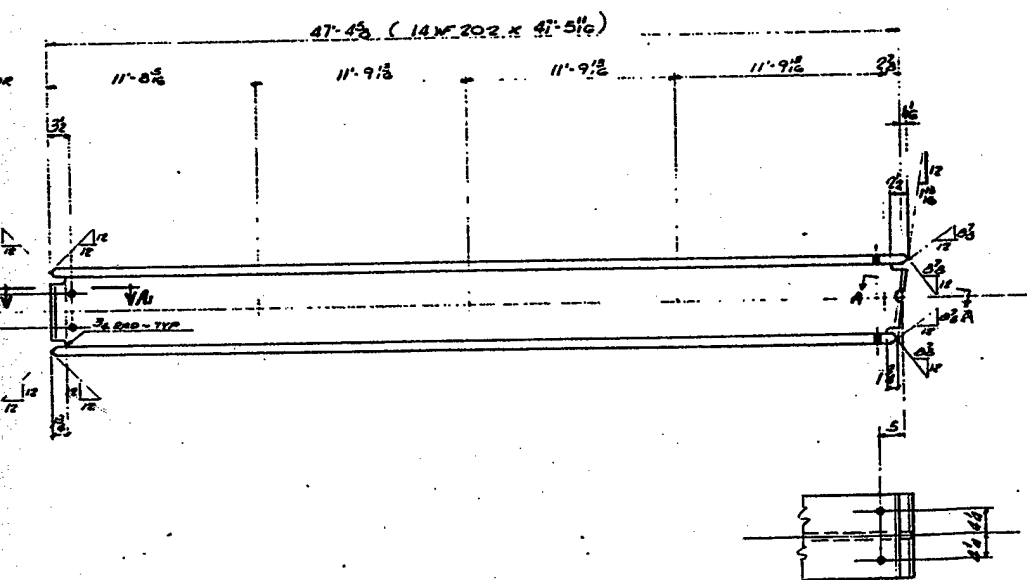
16-STRUTS-AB



SEC. A-A



16-BRACES-CB



16-STRUTS-BB

2

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HOLDER: 12-78 UNLESS NOTED
PARTICULARS: UNLESS NOTED
FROM: NONE

NOTES

NO.	REVISION DESCRIPTION	DATE	BY
1			
2			
3			
4			

DESIGN BY: PC
TRACED BY: PC
CHECKED BY: PC
APPROVED BY: PC



NO ITEM NUMBER 132
CONTRACT NUMBER DAWN 68-74-C-0008

CUSTOMER'S P.O. NO.
CUSTOMER'S OFF. NO.

APPROVAL STAMPS

APPROVED

Substantive conformity with form and content,
comprehension of writer or writer's intent, and his full
and complete understanding of the facts and issues
involved, or acceptability for forwarding and file

**LOWER SNAKE RIVER
RESIDENT OFFICE**

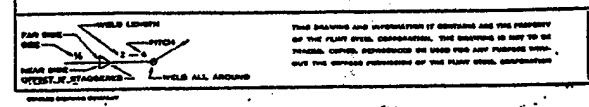
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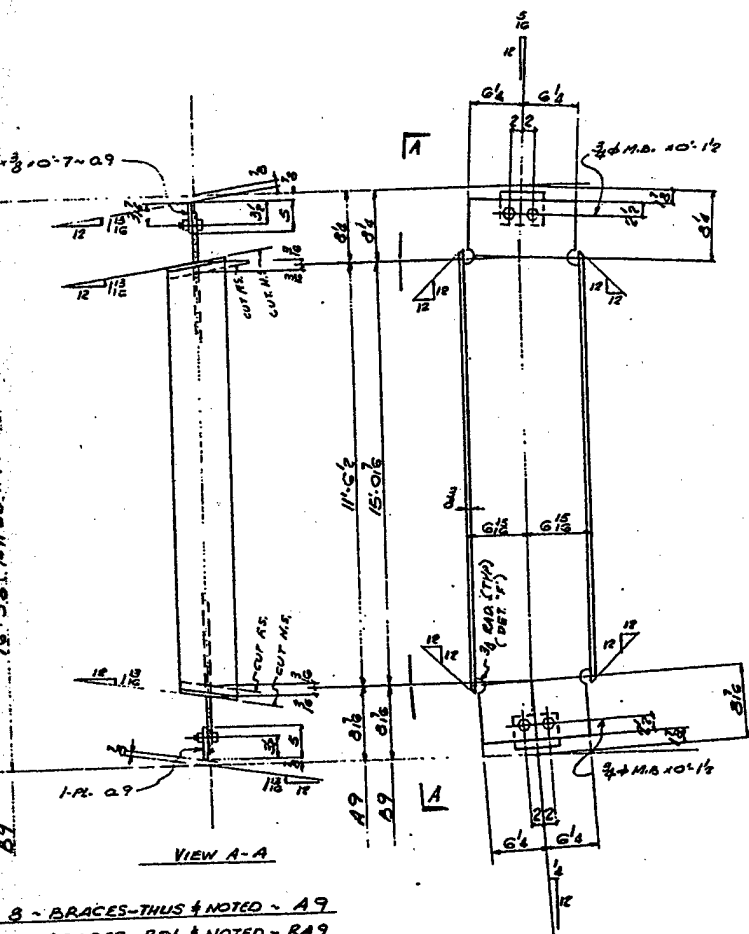
Date **23 SEP 1973**

STRUTS & BRACES
LOWER GRANITE LOCK & DAM
LOWER GRANITE CONT.
PULLMAN WASH.

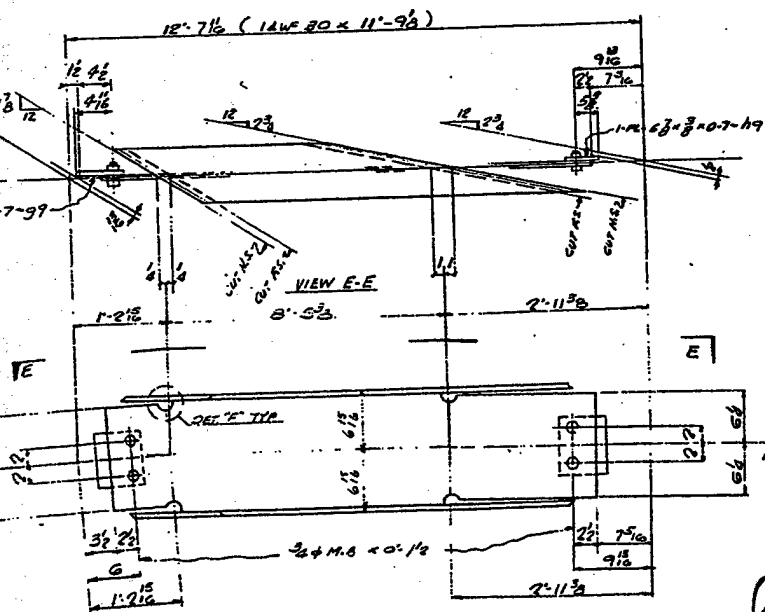
JOB NO.
70-2540
SHEET NO.
8

70-c-88-359

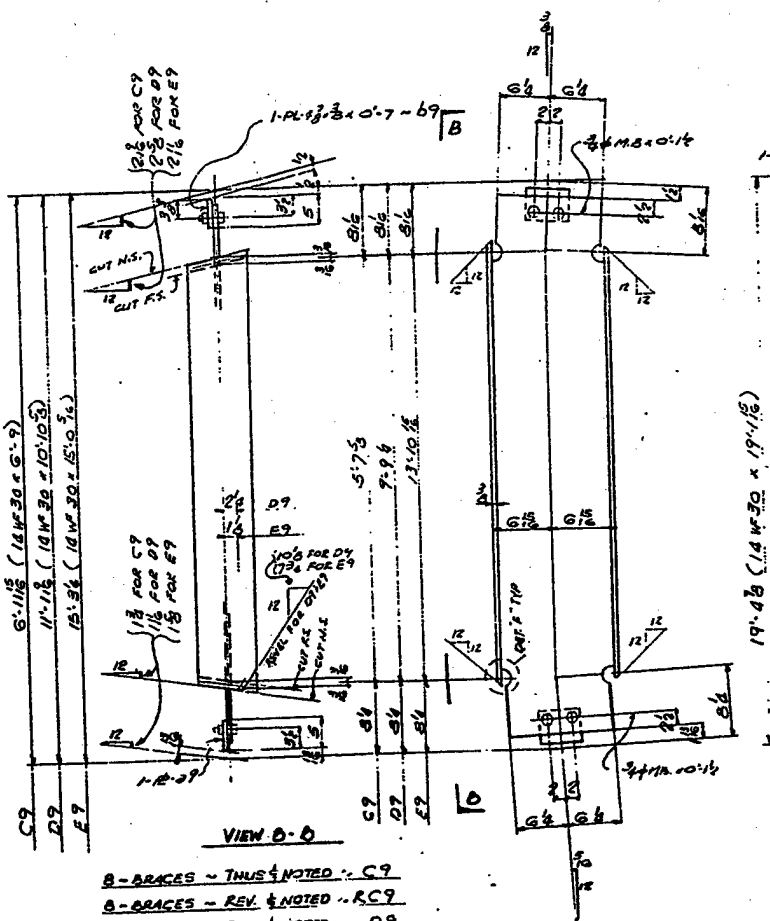




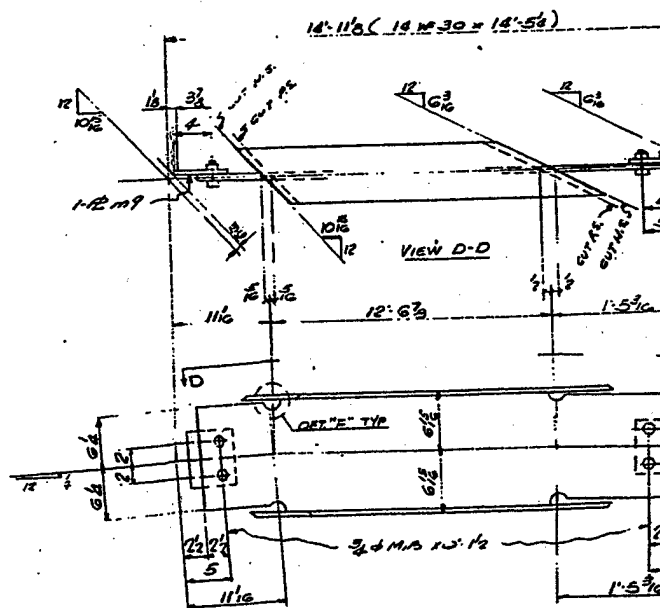
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 B-BRACES-REV & NOTED - RA9
 B-BRACES-THUS & NOTED - B9
 B-BRACES-REV & NOTED - RB9



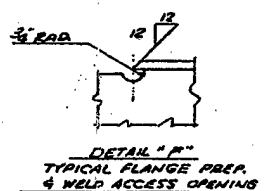
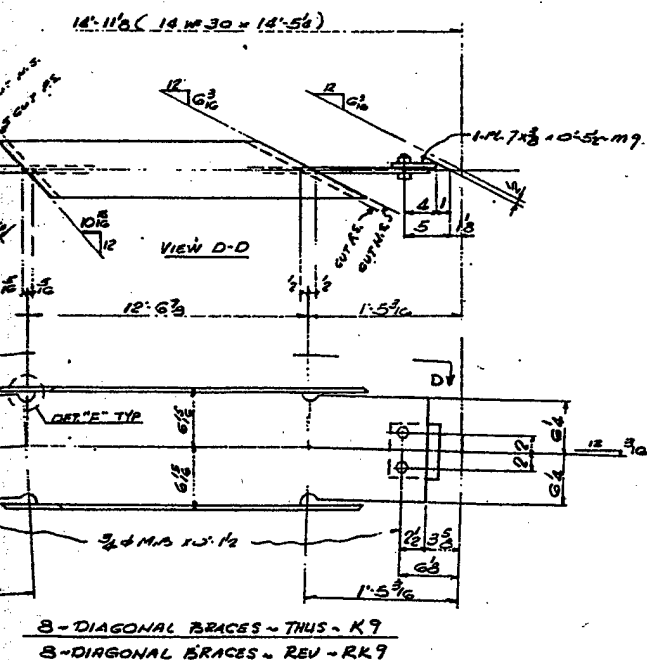
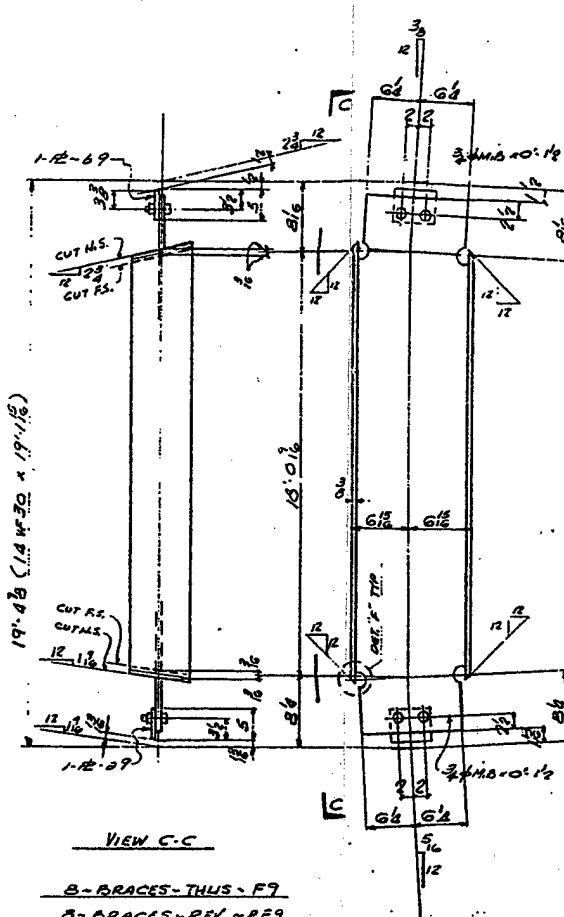
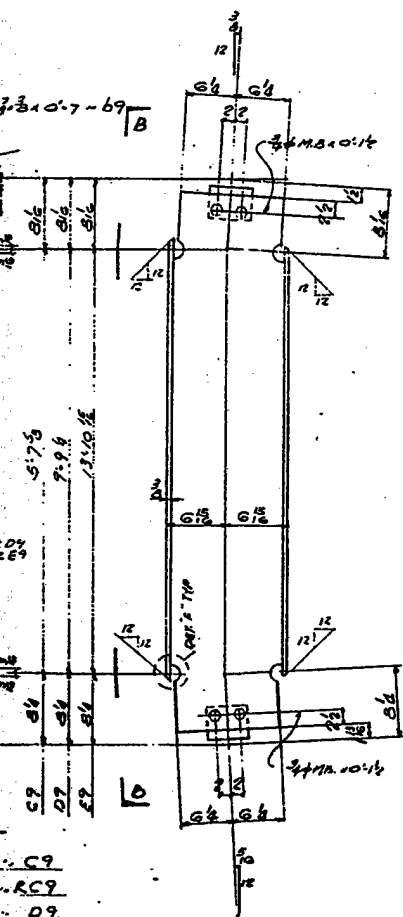
B-DIAGONAL BRACES-THUS - H9
 B-DIAGONAL BRACES-REV - RH9



B-BRACES-THUS & NOTED - C9
 B-BRACES-REV & NOTED - RC9
 B-BRACES-THUS & NOTED - D9
 B-BRACES-REV & NOTED - RD9
 B-BRACES-THUS & NOTED - E9
 B-BRACES-REV & NOTED - RE9



B-DIAGONAL BRACES-THUS - K9
 B-DIAGONAL BRACES-REV - RK9



NOTE
THG ALL MAT'L WITH
ITEM N8 132

NO. PCS.	MARK	MATERIAL	LENGTH FT. IN.	REMARKS	WEIGHT
8	A9	14 WF 30	12 7 3/4		1 1/2
8	RA9	14 WF 30	12 7 3/4		1 1/2
8	A9	14 WF 30	16 1 3/4		1 1/2
8	RA9	14 WF 30	16 1 3/4		1 1/2
60	A9	PL 1/2 x 3	0 7		3/4
120		3/4 x 1/2 x 3	0 1 1/2	FIN-UP	
8	C9	14 WF 30	6 9		1 1/2
8	RC9	14 WF 30	6 9		1 1/2
8	D9	14 WF 30	10 10 3/4		1 1/2
8	RD9	14 WF 30	10 10 3/4		1 1/2
8	E7	14 WF 30	15 0 3/4		1 1/2
8	RE7	14 WF 30	15 0 3/4		1 1/2
48	B9	PL 1/2 x 3	0 7		3/4
48	RB9	PL 1/2 x 3	0 7		3/4
192		3/4 x 1/2 x 3	0 1 1/2	FIN-UP	
8	F9	14 WF 30	19 1 1/4		1 1/2
8	RF9	14 WF 30	19 1 1/4		1 1/2
16	B9	PL 1/2 x 3	0 7		3/4
16	RB9	PL 1/2 x 3	0 7		3/4
60		3/4 x 1/2 x 3	0 1 1/2	FIN-UP	
8	H9	14 WF 30	11 9 3/4		1 1/2
8	RH9	14 WF 30	11 9 3/4		1 1/2
16	B9	PL 1/2 x 3	0 7		3/4
16	RB9	PL 1/2 x 3	0 7		3/4
60		3/4 x 1/2 x 3	0 1 1/2	FIN-UP	
8	K9	14 WF 30	14 5 1/4		1 1/2
8	RK9	14 WF 30	14 5 1/4		1 1/2
32	m9	PL 1/2 x 3	0 3/2		3/4
60		3/4 x 1/2 x 3	0 1 1/2	FIN-UP	

ALL MAT'L A36

NO ITEM NUMBER 132
CONTRACT NUMBER DACH 68-74-C-0008

APPROVED
Subscribed by authority of the Chief Engineer, and to the use of any required funds, hereby approved and authorized the material, as necessary for completing the project.
LOWER SNAKE RIVER
RESIDENT OFFICE
70-0544
83 SEP 1973

LSR 70-0088-132-014

FLINT STEEL CORPORATION
BOX 1246, TULSA, OKLAHOMA 74101
ENGINEERING DEPARTMENT

TRINIDAD ARM BRACING
LOWER SNAKE RIVER
1. SNAKE RIVER
PULLMAN, WASH.

70-0544
SHEET NO. 9

70-C-88-360

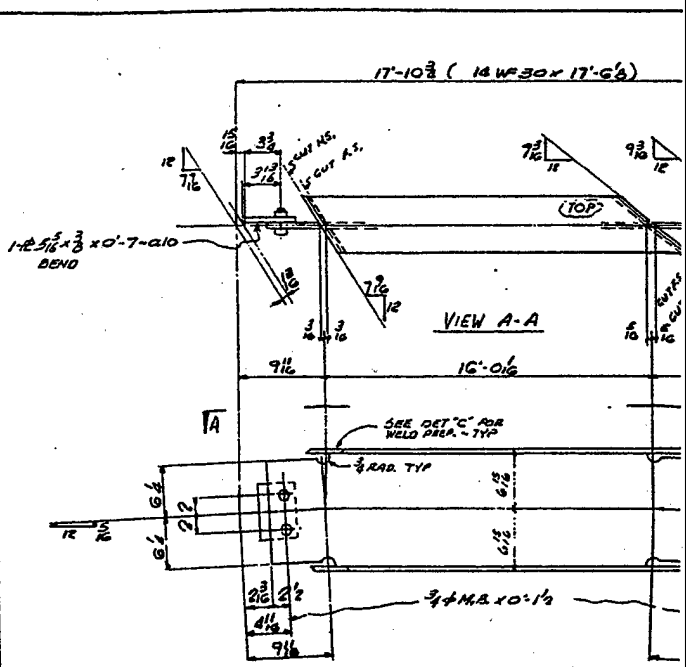
PROJECT NO.
PAGE NO.

DESIGN NAME
DATE
DRAWN BY
CHECKED BY
APPROVED BY

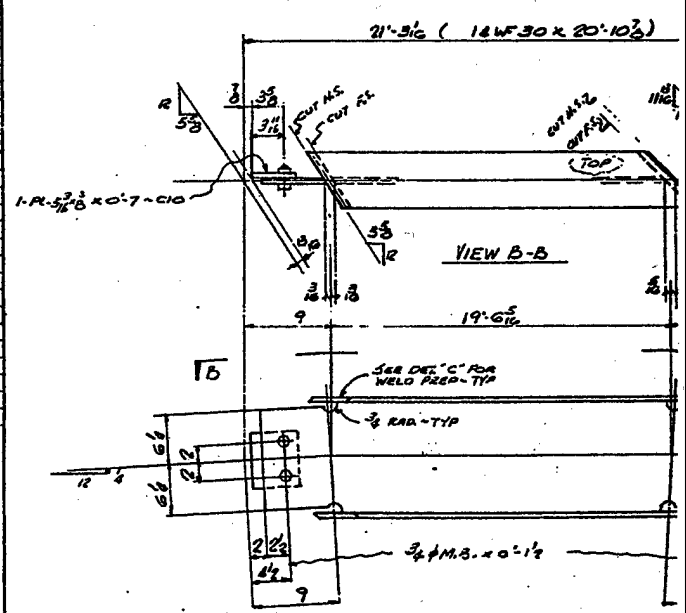
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1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	

DESIGN NAME
DATE
DRAWN BY
CHECKED BY
APPROVED BY

DESIGN NAME
DATE
DRAWN BY
CHECKED BY
APPROVED BY



B-DIAGONAL BRACES - THUS - A
B-DIAGONAL BRACES - REV - RA



B-DIAGONAL BRACES - THUS - B
B-DIAGONAL BRACES - REV - RB

WELD LENGTH

PITCH

WELD ALL AROUND

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DATE

BY

CHECKED

APPROVED

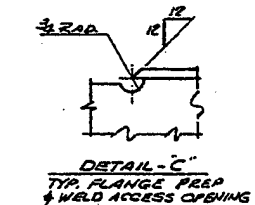
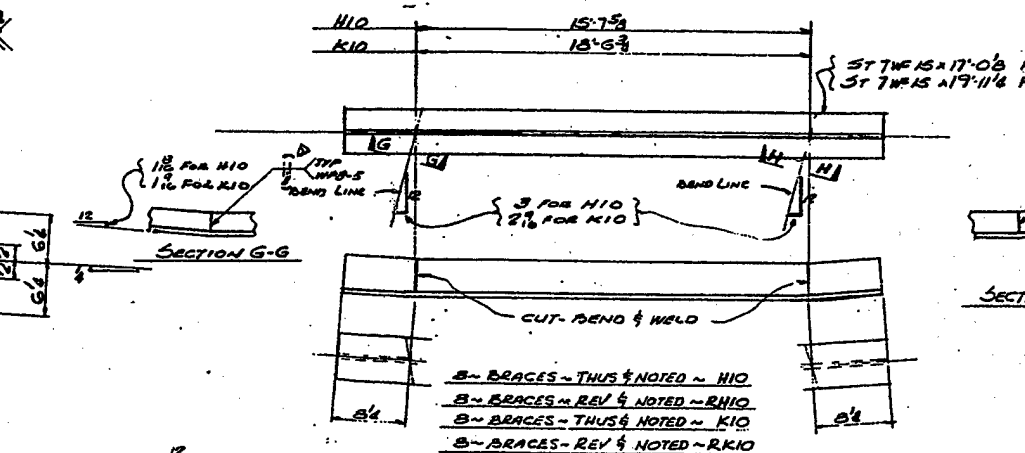
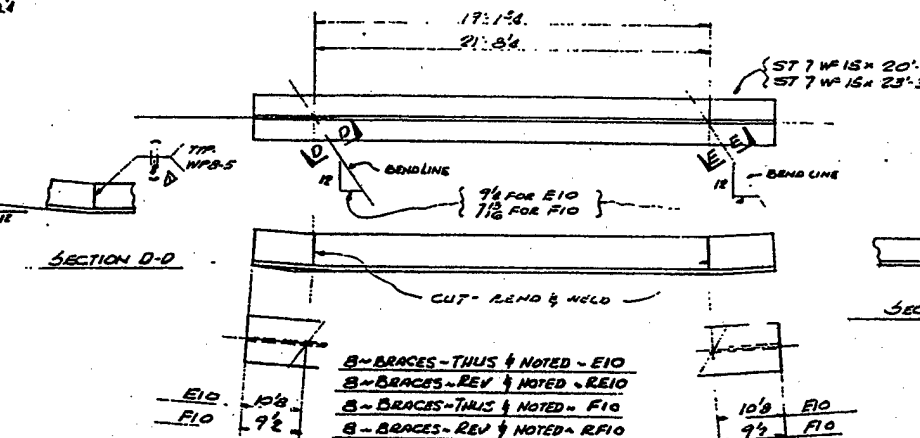
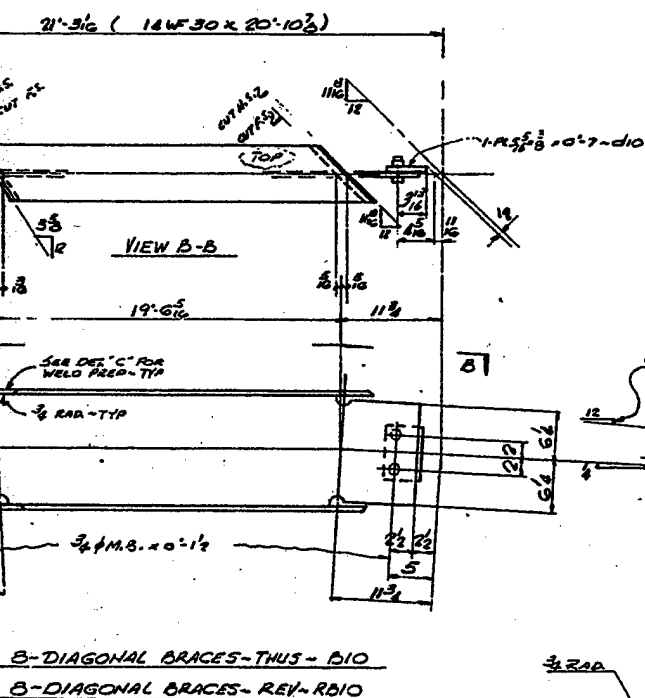
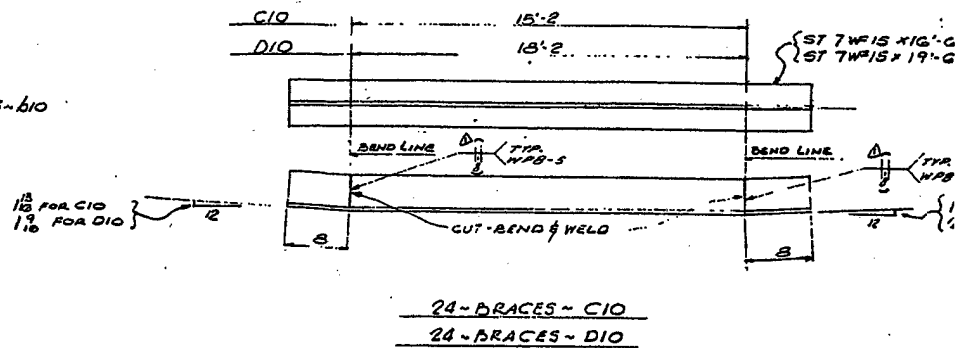
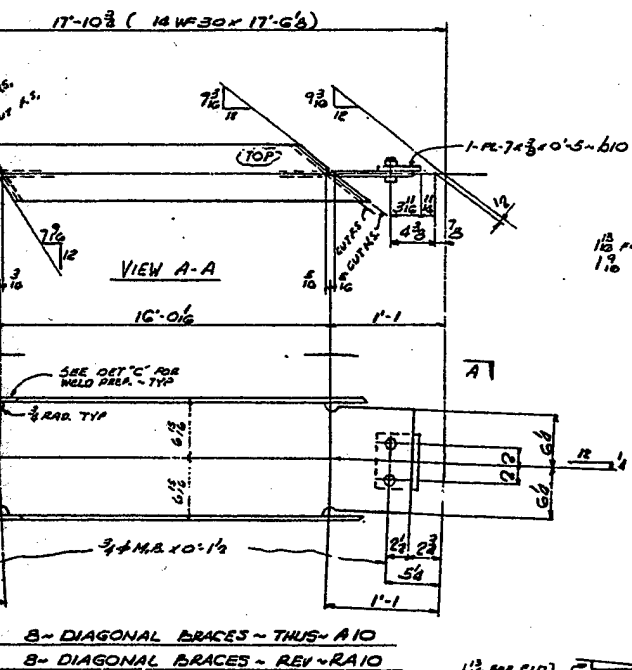
NO. 13

DATE

BY

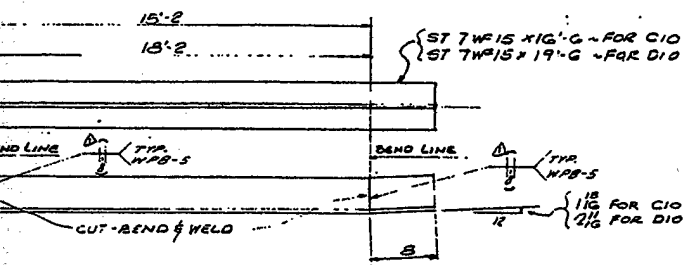
CHECKED

APPROVED



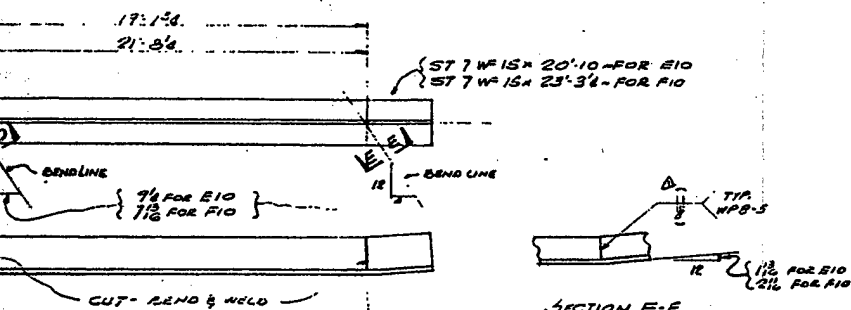
2

19/10/10 HOLE: 19/10/10 PARTS: 19/10/10 FROM: 19/10/10		NOTES:		DRAWN BY: 19/10/10 CHECKED BY: 19/10/10 APPROVED BY: 19/10/10	
19/10/10 19/10/10 19/10/10		19/10/10 19/10/10 19/10/10		19/10/10 19/10/10 19/10/10	



24-BRACES ~ C10

24-BRACES ~ D10

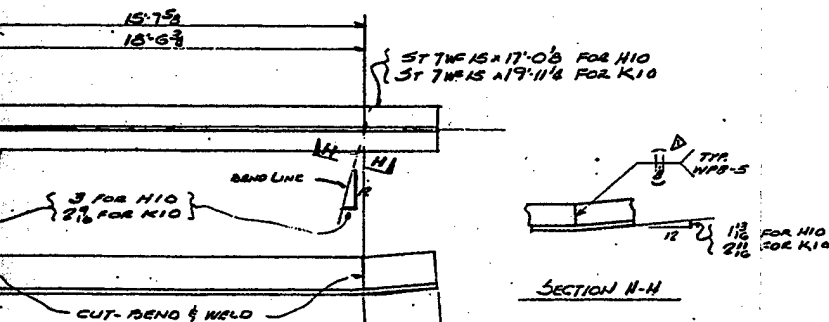


B-BRACES-THUS & NOTED ~ E10

B-BRACES-REV & NOTED ~ RE10

B-BRACES-THUS & NOTED ~ F10

B-BRACES-REV & NOTED ~ RF10



B-BRACES-THUS & NOTED ~ H10

B-BRACES-REV & NOTED ~ RH10

B-BRACES-THUS & NOTED ~ K10

B-BRACES-REV & NOTED ~ RK10

NOTE
TAG ALL MATERIAL
WITH ITEM N° 132

NO. PCS.	MARK	MATERIAL	LENGTH FT. IN.	REMARKS	WEIGHT
B A10	18W30		17 6/8		120
B B10	18W30		17 6/8		120
16 C10	PL 5/8 x 3/4		0 7		37
16 D10	PL 5/8 x 3/4		0 5		37
64	3/4 x 1/2		0 1/2		
B E10	18W30		20 10/8		120
B F10	18W30		20 10/8		120
16 G10	PL 5/8 x 3/4		0 7		37
16 H10	PL 5/8 x 3/4		0 7		37
64	3/4 x 1/2		0 1/2		
24 C10	ST 7W15		16 6	BEND 1/4	
24 D10	ST 7W15		19 6	BEND 3/4	
B E10	ST 7W15		20 10	BEND 3/4	
B F10	ST 7W15		20 10		
B G10	ST 7W15		23 3/4		124
B H10	ST 7W15		23 3/4		124
B I10	ST 7W15		17 0/8	BEND 1/4	
B J10	ST 7W15		17 0/8		124
B K10	ST 7W15		19 11/2		124
B L10	ST 7W15		19 11/2		124
4 BUTT WELD	66	0			

NO ITEM NUMBER 132
CONTRACT NUMBER DACH-68-70-C-0088

APPROVED

LOWER SNAKE RIVER
RESIDENT OFFICE

25 SEP 1973

LSR 70-0088-132-015

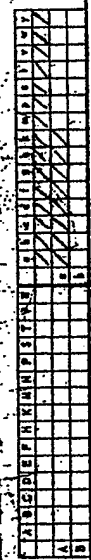
DRAWN BY PC DATE 12-8-70
CHECKED BY CM DATE 12-22-70
APPROVED BY DATE

FLINT STEEL CORPORATION
BOX 1886, TULSA, OKLAHOMA 74101
ENGINEERING DEPARTMENT

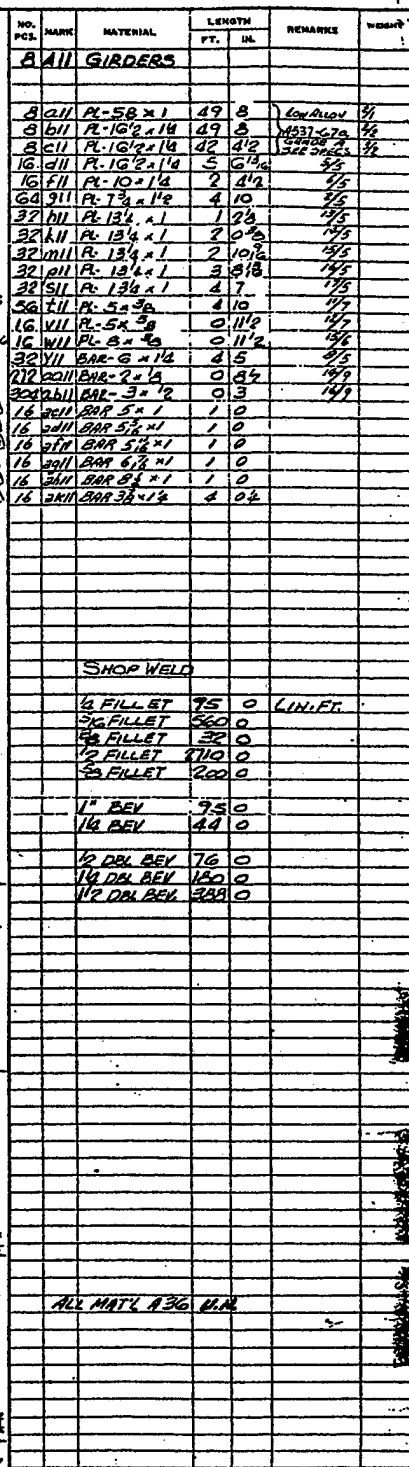
TRUNNION ARM BRACING
LOWER GRANITE LOCK DAM
LOWER GRANITE CONTR
PULLMAN, WASH

JOB NO 70-0544
SHEET NO 10

70-C-88-361



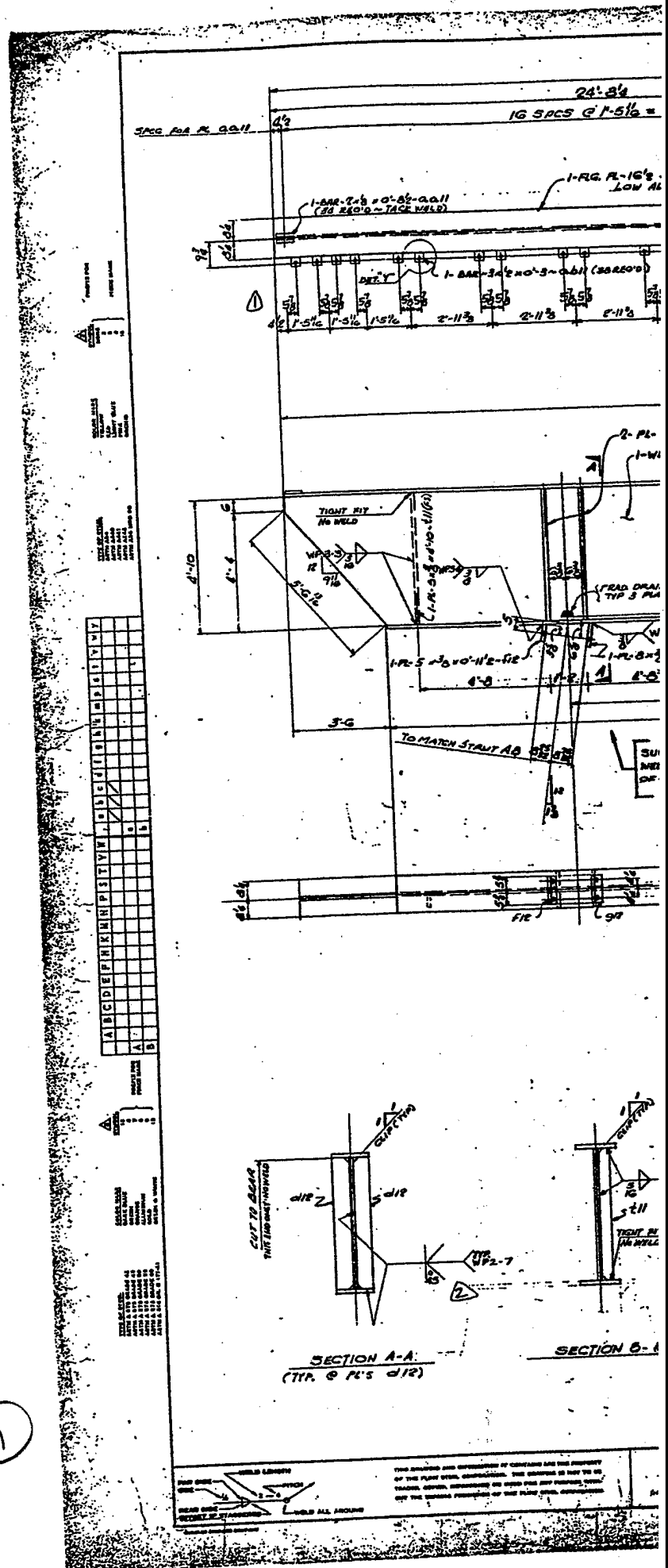
The diagram illustrates the path of a plastic film as it is extruded and then wound onto a reel. The film starts at the extruder, moves horizontally to the right, then turns 90 degrees downward, and finally turns 90 degrees to the left to wind around a reel. The horizontal section is labeled 'WIND LENGTH'. The vertical section is labeled 'WIND AREA'. The section where the film winds around the reel is labeled 'WIND AREA, AROUND'.

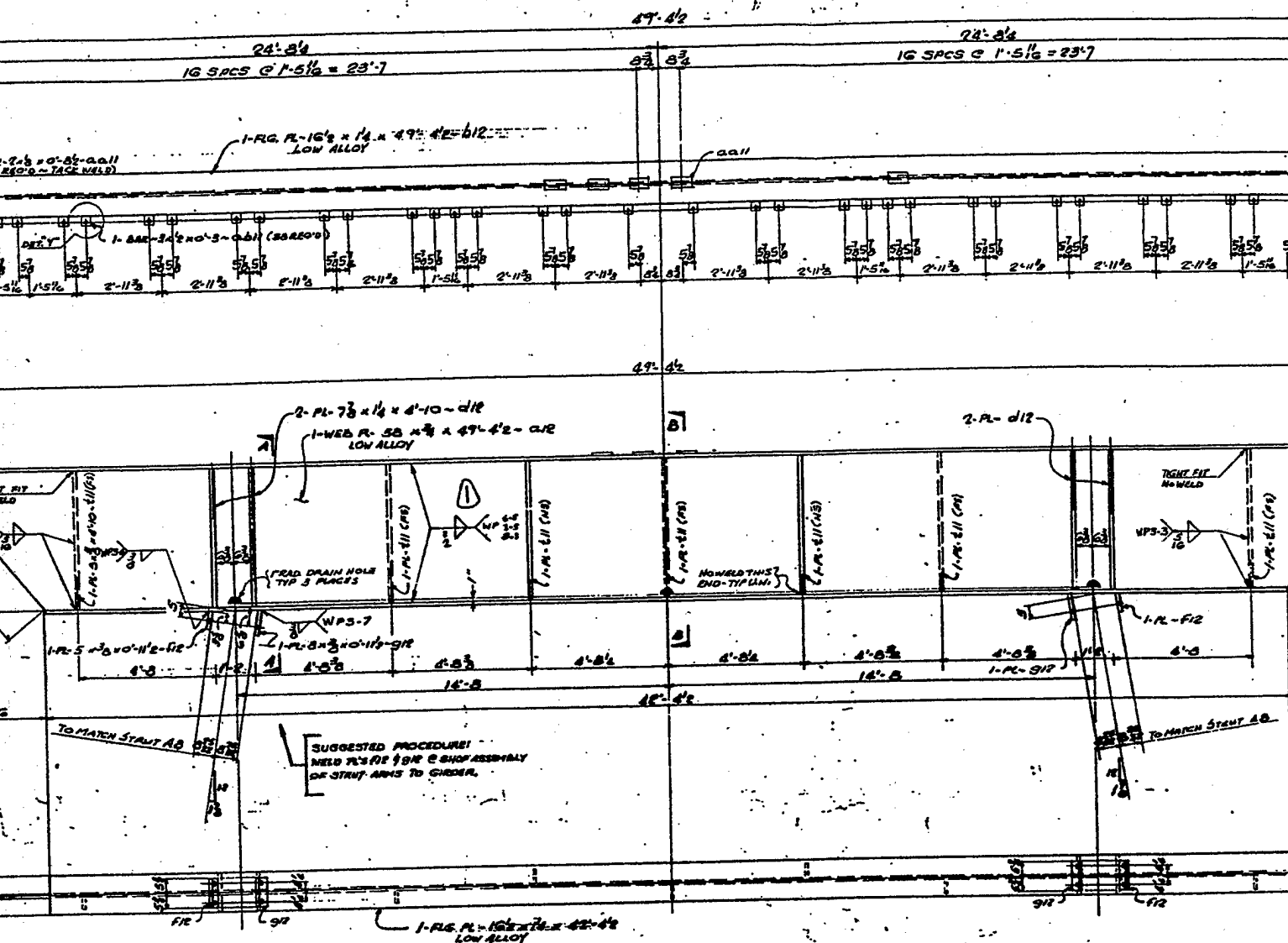


25 SEP 1973

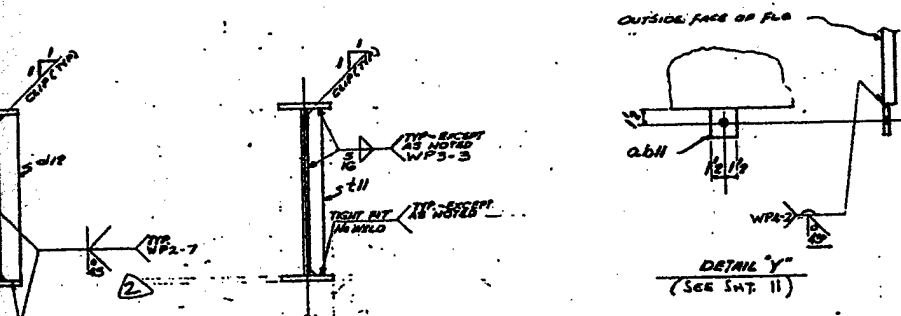
GIRDER, H-1
LOWER SPINTELICK DAM
- LOWER SPINTELICK
PULMAN, WASH.

70-C-88-362





8-GIRDERS - A12 (GIRDER NO 8)



(2)

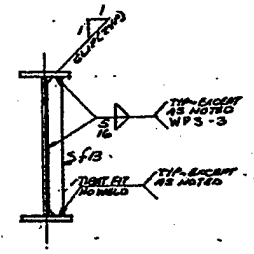
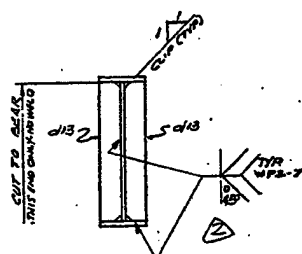
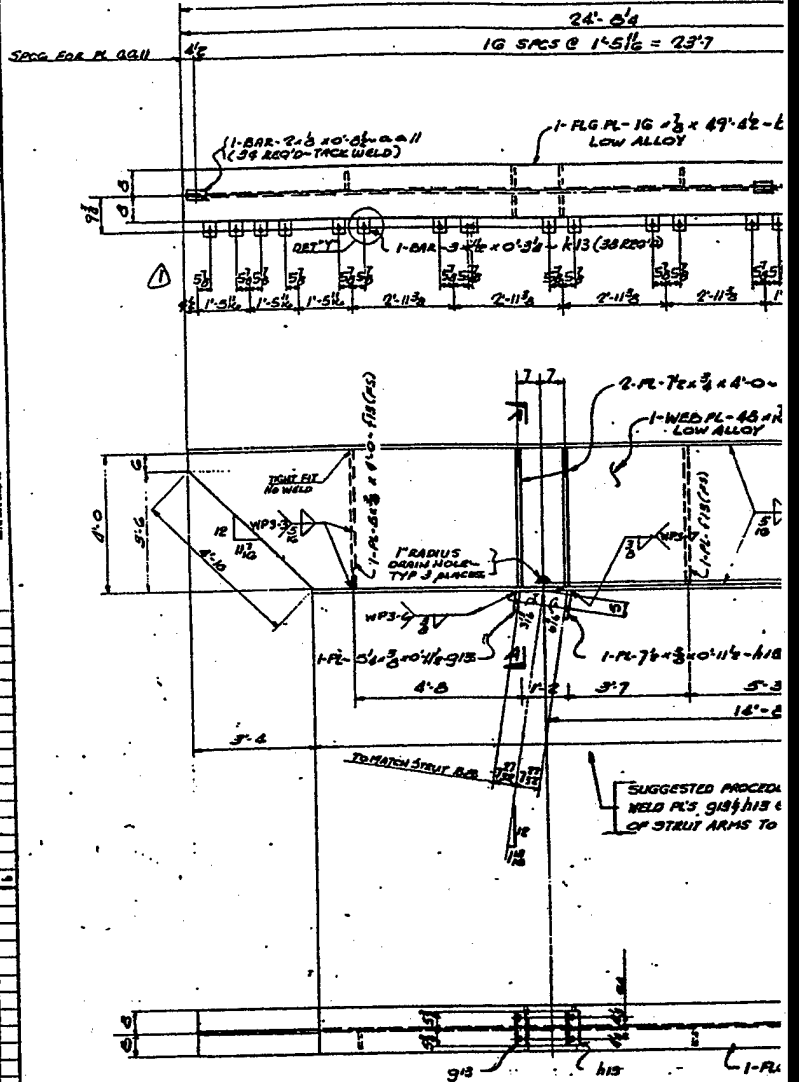
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DESIGNED BY: 120
CHECKED BY: 120
IN CHARGE: 120

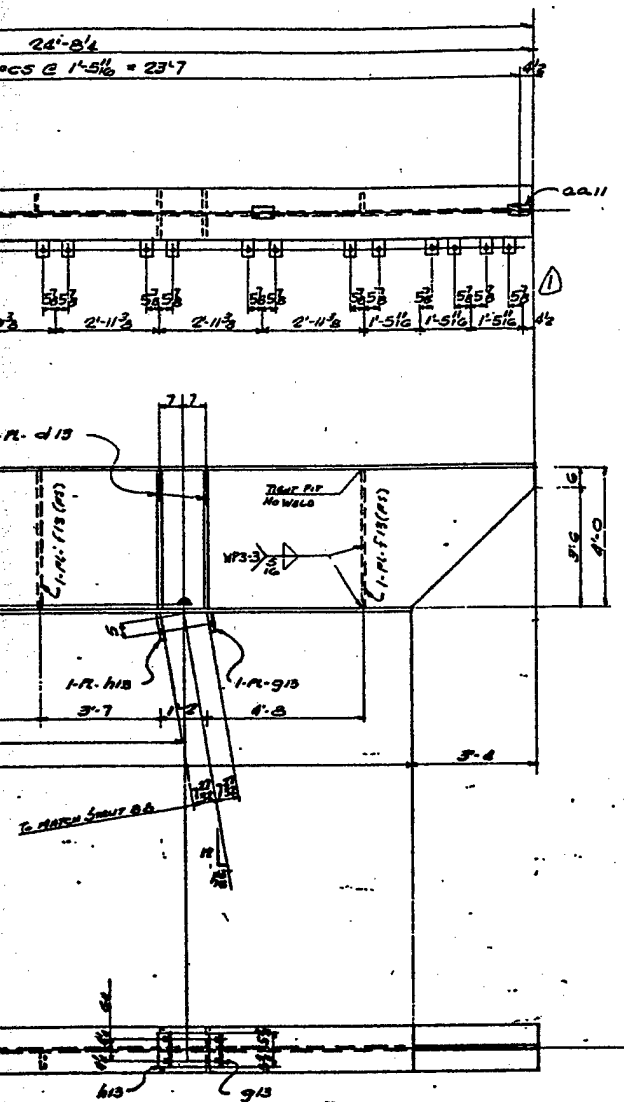
NOTES

1. REVISED WELD SYMBOL
2. REV. TYP. APPROX. SAMA PAPER 3-15-71

DRAWN BY: 120
CHECKED BY: 120
IN CHARGE: 120



A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	



NO. PCS.	MARK	MATERIAL	LENGTH		REMARKS	WEIGHT
			FT.	IN.		
A13 GIRDERS						
8 Q13	R-48 x 7/8	49	4'2"	LOW ALLOY	91	
8 Q13	R-16 x 1 1/8	49	4'2"	SA-537-42A	81	
8 Q13	R-16 x 1 1/8	42	8'1/2"	SA-537-42A	72	
6 Q13	R-72 x 3/4	40			78	
5 Q13	R-5 x 3/4	40			77	
16 Q13	R-5 1/2 x 3/4	0	11'1/2"		36	
16 Q13	R-7 1/2 x 3/4	0	11'1/2"		46	
32 Q13	BAR 3/4 x 1/2	0	3'4"		179	
22 Q11	BAR-2 1/2 x 1/4	0	8'2"		199	
SHOP WELD						
	5/8 FILLET	1940	0			
	3/4 FILLET	32	0			
	1/2 DEL BEV	76	0			
	3/4 DEL BEV	283	0			
ALL MAT'L A36 U.S.A.						

NOTE
TAG ALL MATERIAL
WITH ITEM NO 132

END ITEM NUMBER 132
CONTRACT NUMBER DFCW G8-70-0088

APPROVAL STAMP

APPROVED
Subject to conditions:
any material used in this project must be of the same grade and specification as that specified in the contract documents and approved by the Resident Engineer.
LOWER SHAKE RIVER
RESIDENT ENGINEER
By: *[Signature]*
Date: 25 SEP 1970

LSR70-0088-132-018

DRAWN BY: *[Signature]* DATE: 12-10-70
CHECKED BY: *[Signature]* DATE: 12-22-70
APPROVED BY: *[Signature]* DATE: *[Blank]*

FLINT STEEL CORPORATION
BOX 1288, TULSA, OKLAHOMA 74101
ENGINEERING DEPARTMENT

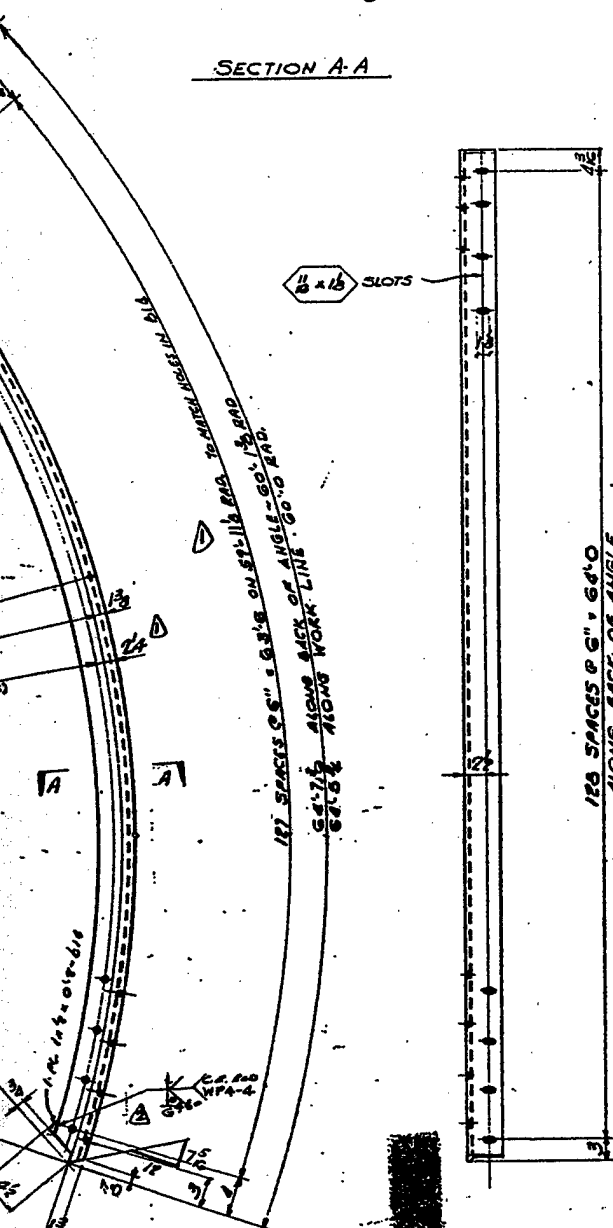
GIRDER No. 3
LOWER GRANITE LOCK & DAM
LOWER GRANITE CANAL
FLINTMAN, WASH.

JOB NO.
70-0544
SHEET NO.
13

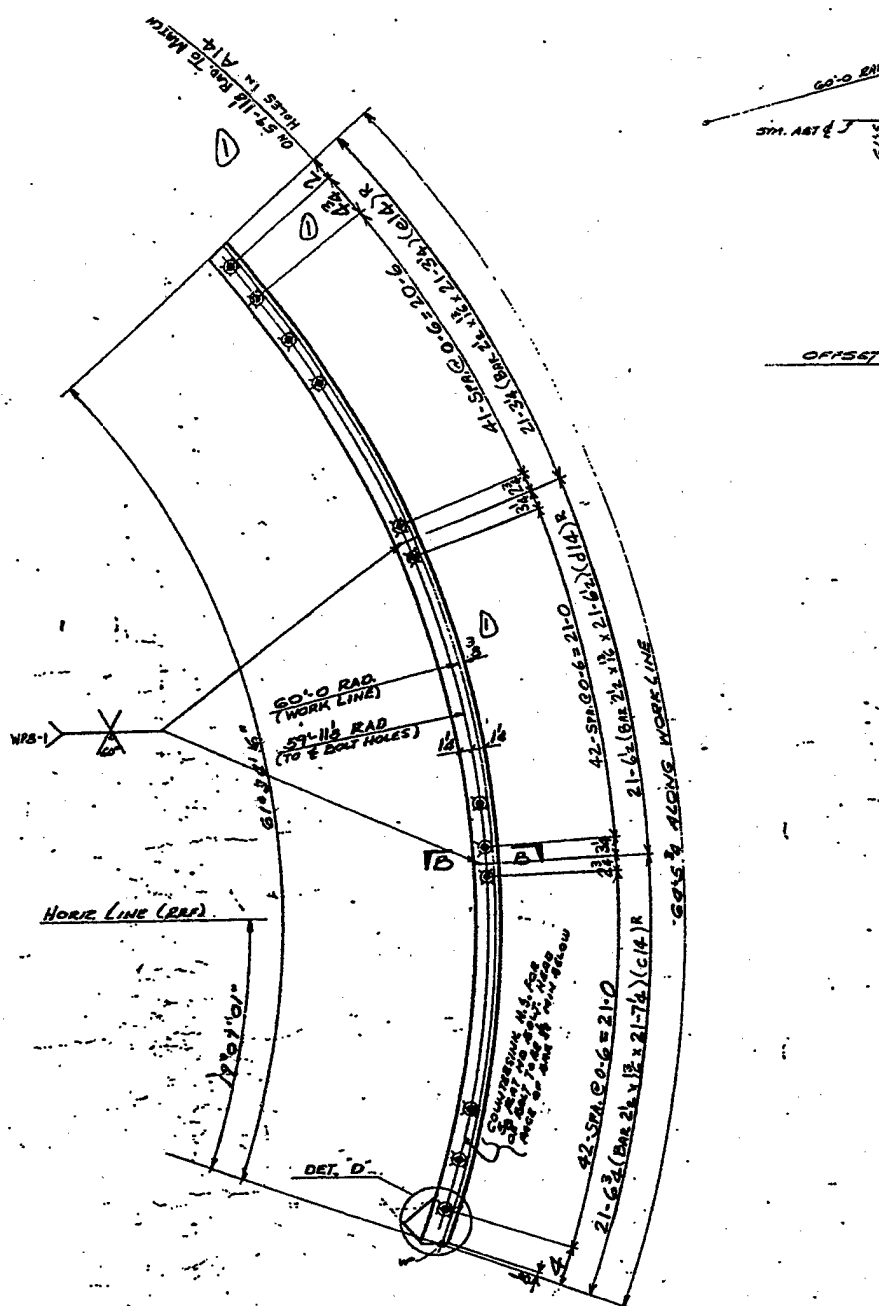
70-C-89-365

①

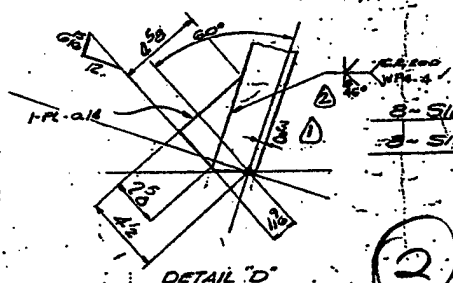
SECTION A-A



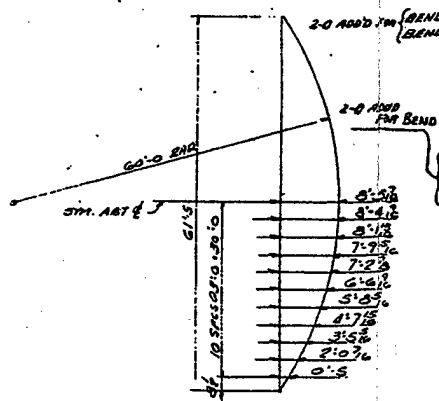
SIDE SEAL ANGLES-THUS - A14
SIDE SEAL ANGLES-REV.-RA14



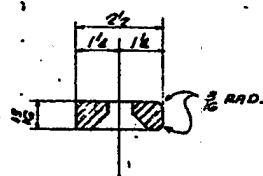
8- SIDE SEAL CLAMPING BARS~THUS - B/4
8- SIDE SEAL CLAMPING BARS~REV~R/B/4



DETAIL "D"



OFFSET DIAGRAM



SECTION 3-B

SNAP WIELD

2	OBLV WELD	3	0	CORR RES
1 1/2	↓	6	0	↓

NOTE
TAG ALL MAT'L WITH
ITEM NO 132

END OF THE POLYMER 132

CONTRACT NUMBER *DACW 68-70-C-0088*

APPROVAL STAMPS

APPROVED

LOWER SHAKA RIVER
RESIDENT OFFICE.

LOWER SNAKE RIVER
RESIDENT OFFICE.

جانب (۱۰)

25 SEP 1973

1

LSR 70-0088-132-019

FLINT STEEL CORPORATION

BOX 1299, TULSA, OKLAHOMA 7410

ENGINEERING DEPARTMENT

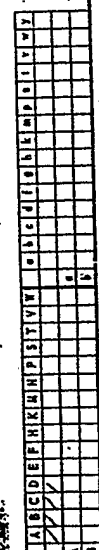
SIDE SEAL ANGLES & BARS
LOWER GRANITE LOCK & GUM
- LOWER GRANITE CONTR.
- FREEMAN WASH

JOHN FOL.
70-0501

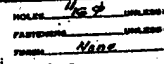
WEEKLY ROL

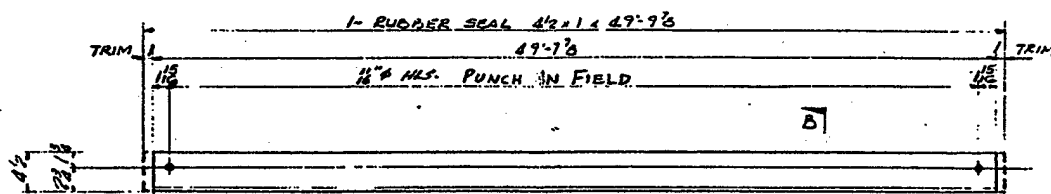
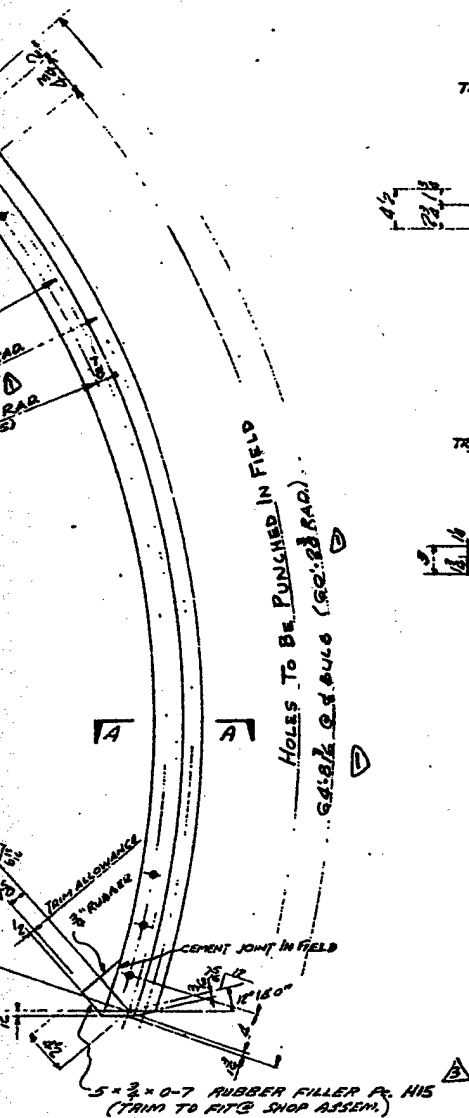
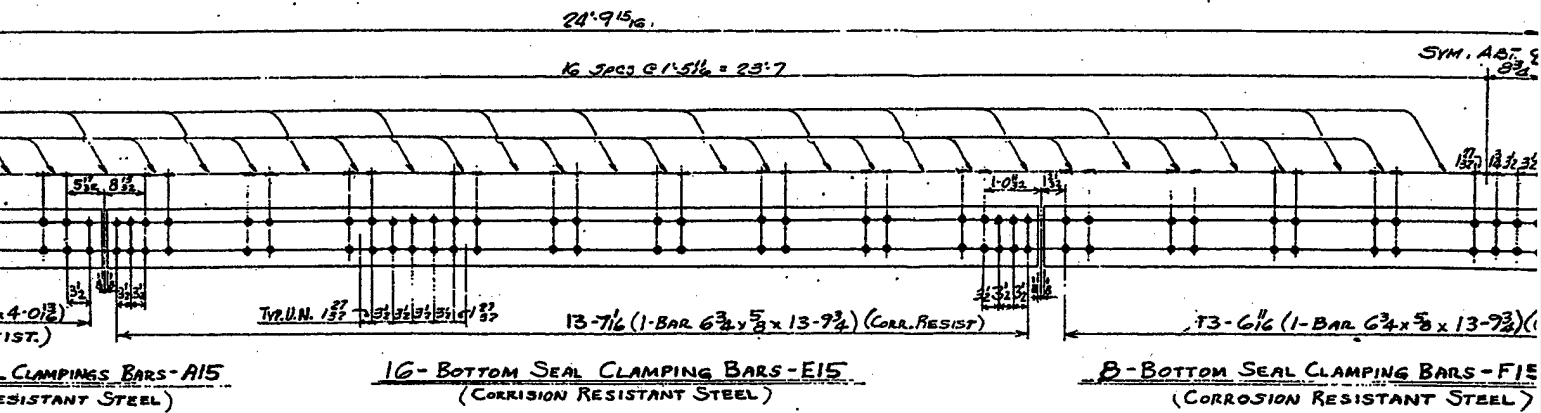
14.

70-C-88-36

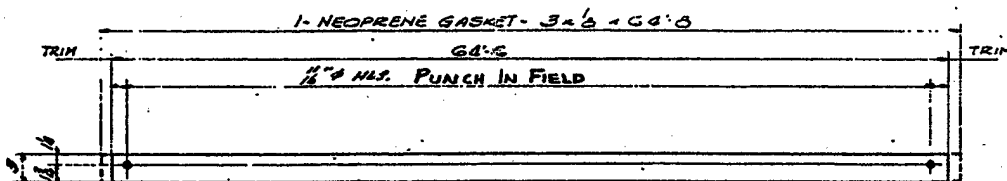


8~RUBBER "J" SEALS~REV~RB15





B - RUBBER BOTTOM SEALS - C15



16 - GASKETS - D15

NOTE
TAG ALL
WITH IT.

SEALS - THUS - A15

SEALS - REV - RB15

DATE	24-9-70	DESIGNED BY	D.N. 2-0-70	DRAWN BY	PC	DATE	12-8-70	FLINT	1
BY	CHINA PLAN DE BUREAU EN H15	CHECKED BY	CHINA PLAN DE BUREAU EN H15	TRACED BY		DATE		BOX	100
BY	REV. PER APPROV. 5-12-71	CHECKED BY	CHINA PLAN DE BUREAU EN H15	APPROVED BY	CHINA PLAN DE BUREAU EN H15	DATE	12-8-70	ENGR	

SECTION
PAGE NO.

SECTION
PAGE NO.

SECTION
PAGE NO.

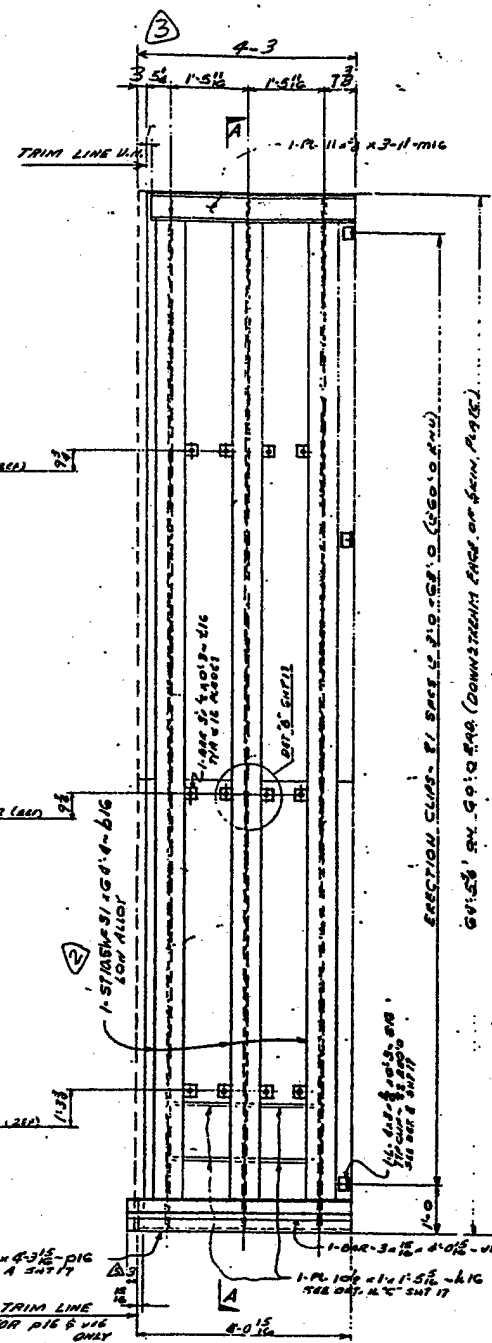
SECTION
PAGE NO.

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z

SECTION
PAGE NO.

SECTION
PAGE NO.

SECTION
PAGE NO.



DOWNSTREAM ELEVATION

FOR ALL WELD LENGTHS

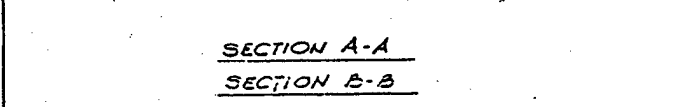
SEE DETAIL A SNT 17

WELD ALL JOINTS

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HOLD FASTENERS

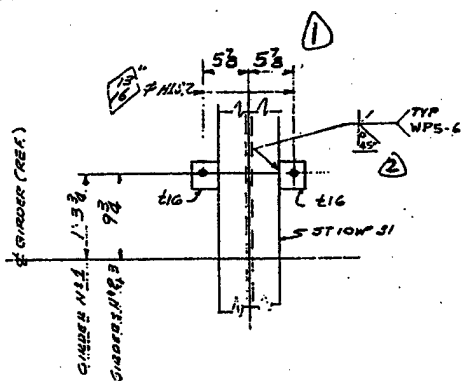
1

[illegible][illegible]

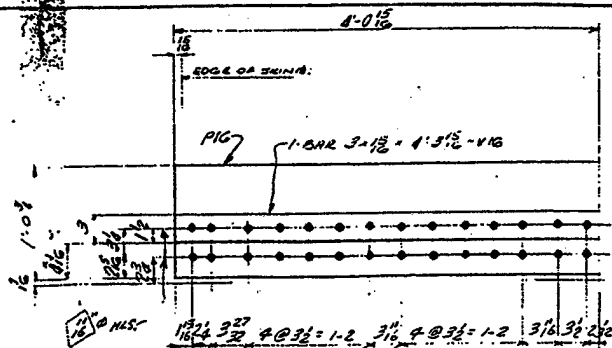
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HOLE _____
 FASTENER _____
 FINISH *MC*

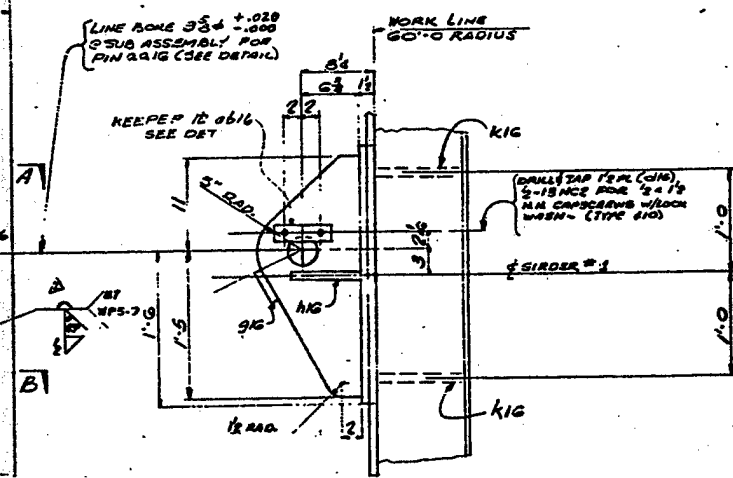
OFFICE OF THE ATTORNEY GENERAL - NEW YORK, NEW YORK



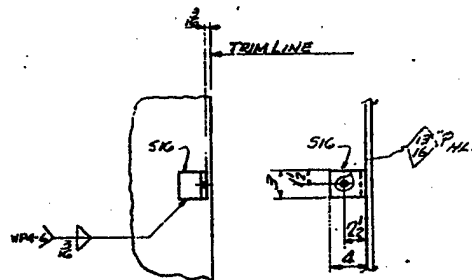
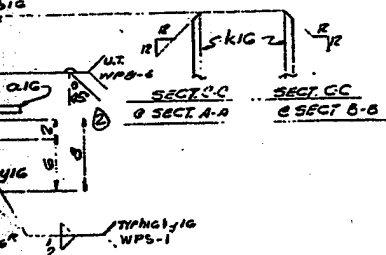
DETAIL "A"
(TYP RIB TO GIRDER CONN)



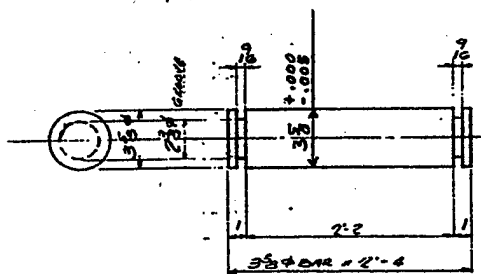
SECTION D-D



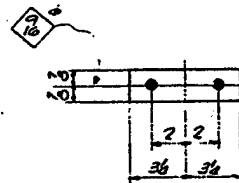
DETAIL "C"



DETAIL "E"
ERECTION CLIP DETAIL



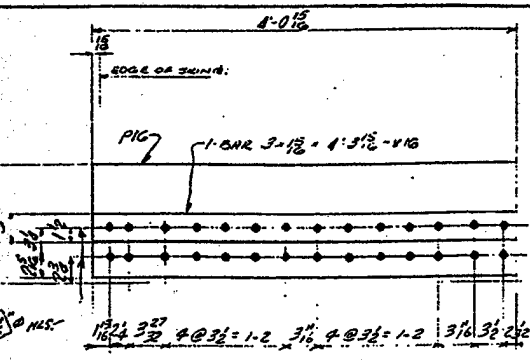
QO-S-763 TYPE 410, COND. T.
(GRADE 3 1/2" O.D.)
16-LIFTING PIN - QOIG



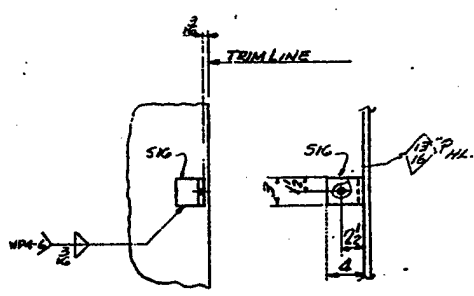
32-BAR-1 1/2" O.D. - QOIG
QO-C-753 TYPE 3-3, COND. A

(2)

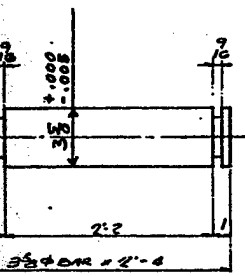
THE PROPERTY OF THE COMPANY NO. 1000, TULSA ENGINEERING	HOLE: _____ FASTENERS: _____ FINISH: NONE	NOTES: _____ 1. _____ 2. _____	SHOW WL. SIZE @ SECT. D-D REV. 11/1/77 REV. 11/1/77 REV. 11/1/77	DRAWN BY: PE DATE: 11/1/77 CHECKED BY: C.M. DATE: 11/1/77	FLINT STEEL BOX 1000, TULSA ENGINEERING
---	---	--------------------------------------	---	--	---



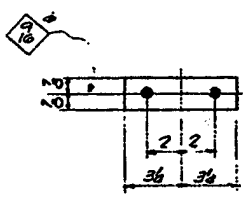
SECTION D-D



DETAIL "S"
ERECTION CLIP DETAIL



5-TG3 TYPE A10, COND. T.
(ORDER 3/8" P.O.D.)
5-LIFTING PIN - QA16



32-BAR 1/2" x 1'-0" x 1/16"
40-C-TG3 TYPE 3-2, COND. A

3

CUSTOMER'S P.O. NO.
CUSTOMER'S DATE, MO.

NO ITEM NUMBER 132
CONTRACT NUMBER DHEW-68-70-C-0088

APPROVAL STAMPS

APPROVED

LOWER SNAKE RIVER
RESIDENT OFFICE

25 SEP 1973

LSR70-0088-132-022

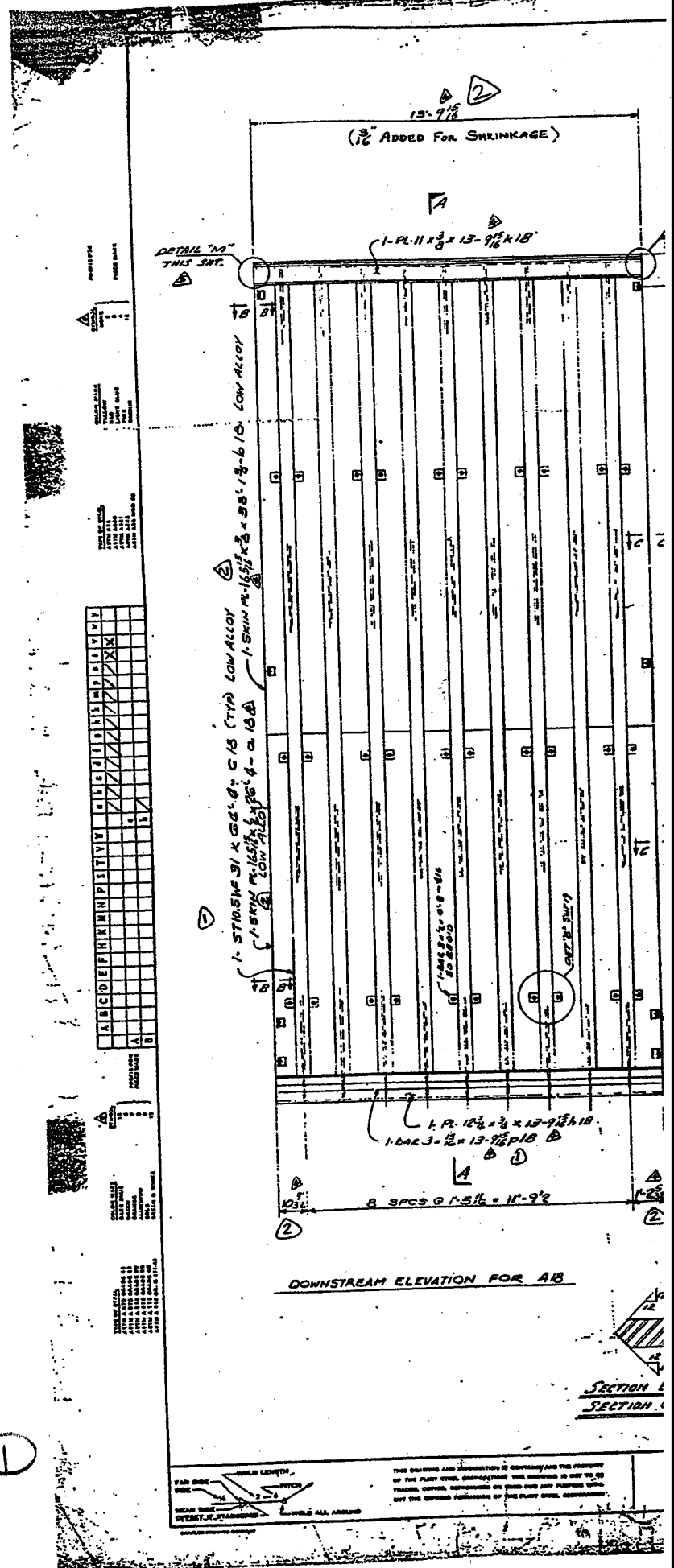
DESIGN BY PE DATE 12-9-70
CHECKED BY CM DATE 12-12-70
APPROVED BY DATE

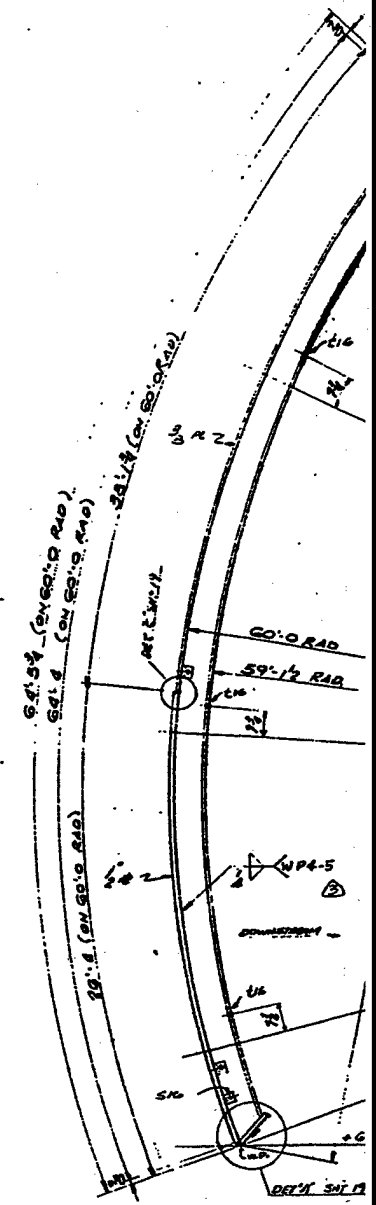
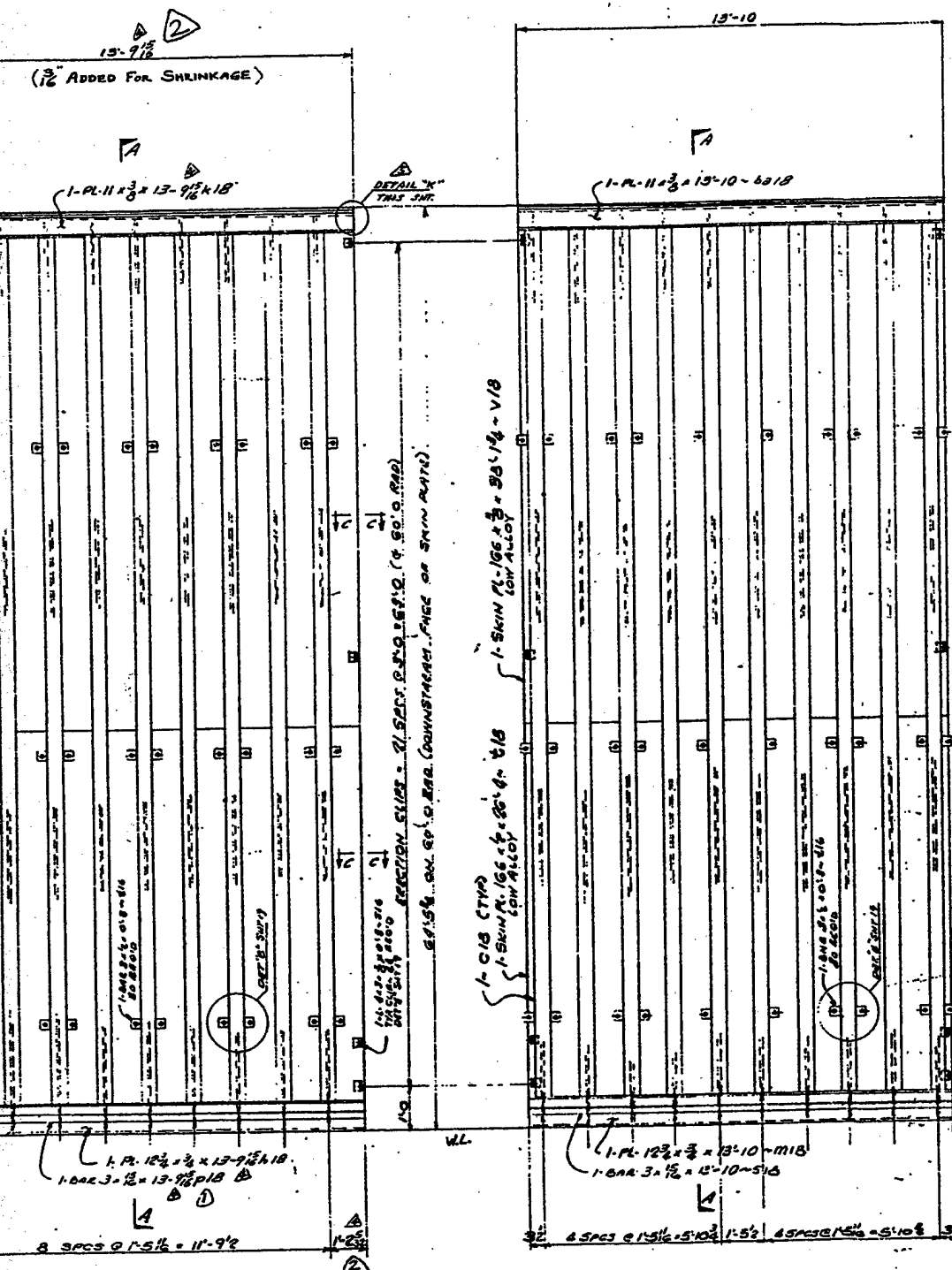
FLINT STEEL CORPORATION
BOX 1289, TULSA, OKLAHOMA 74101
ENGINEERING DEPARTMENT

SKIN PLATE ASS'Y DETAILS
LOWER GRANITE LOCK & DAM
LOWER GRANITE CENTER
PULLMAN, WASH.

FOR FILE
70-0544
DATE
FT

70-C-88-369



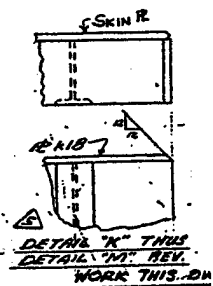


STREAM ELEVATION FOR A/B

DOWNSTREAM ELEVATION FOR B/B

- 8 - SKIN PLATE ASSEMBLIES - THUS 4 NOTED - A/B
- 8 - SKIN PLATE ASSEMBLIES - REV 4 NOTED - R/A/B
- 8 - SKIN PLATE ASSEMBLIES - THUS 4 NOTED - B/B

SECTION B-B THUS
SECTION C-C REV.



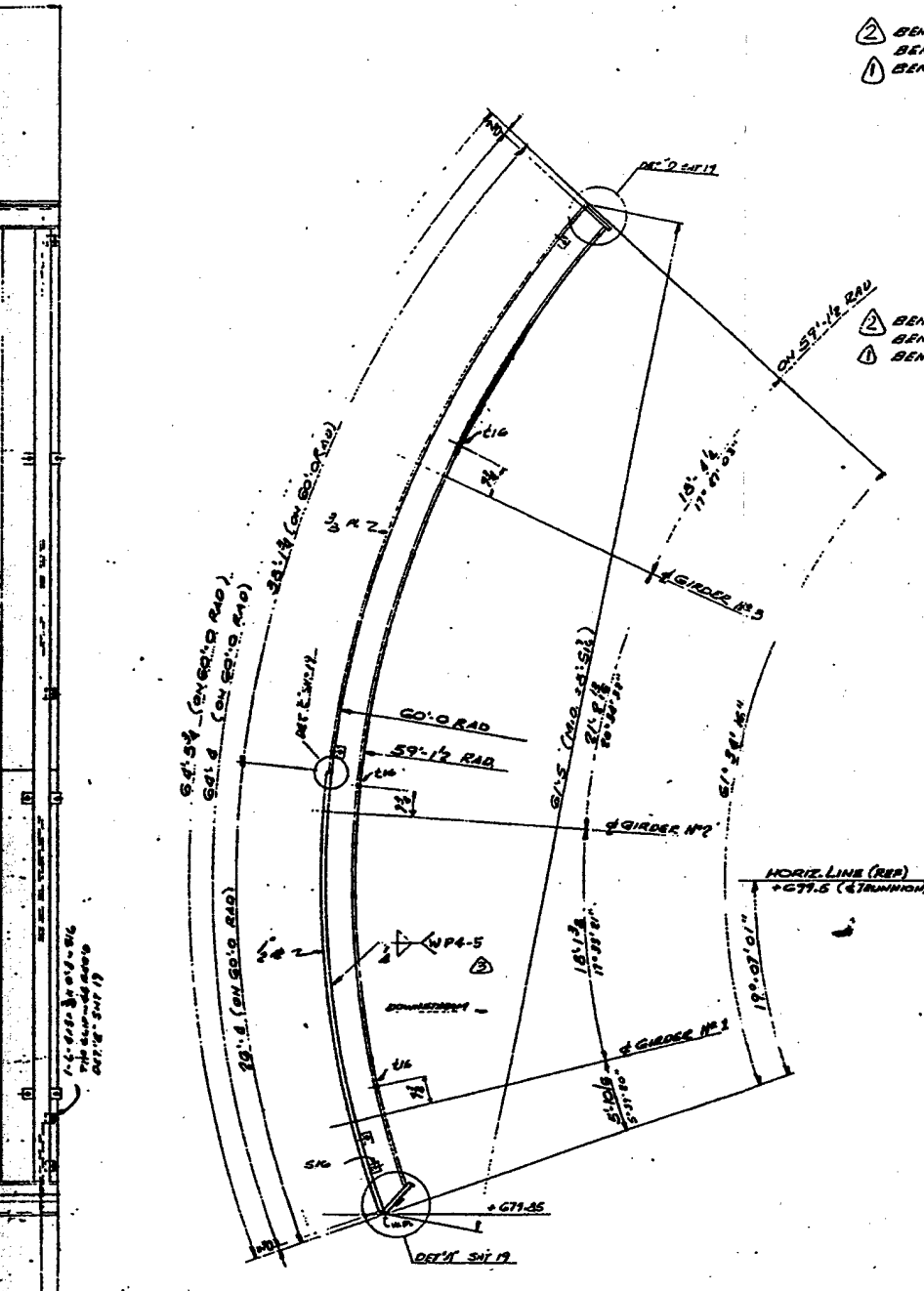
2

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HOLDER: UNLESS NOTED
FASTENERS: UNLESS NOTED
FORM: NONE

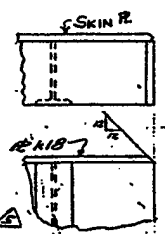
NOTES

ADD DETAILS "K" & M. G. ON	DATE	BY
ADD DET. B-C & CORRECT DET. C-D FOR ON	DATE	BY
REVIEWED: [Signature]	DATE	BY
DESIGNED: [Signature]	DATE	BY
GENERAL REVISION	DATE	BY



SECT A-A

NOTE
TAG ALL MATERIAL
WITH I-2EN NR 132



DETAIL "K" THIS
DETAIL "M" REV.

WORK THIS DWG W/ DWG NR 19

QTY	MARK	MATERIAL	LENGTH FT. IN.	REMARKS
8	A18	SKIN PL ASSYS		
8	B18	SKIN PL ASSYS		
2	BEND	16 1/2 PL 166 X 1/2	26 4	ASTM A36
2	BEND	16 1/2 PL 166 X 3/4	38 1/4	ASTM A36
1	BEND	16 1/2 PL 166 X 1	64 1/2	ASTM A36
1	BEND	16 1/2 PL 166 X 1 1/4	13 7/8	8/6
1	BEND	16 1/2 PL 166 X 1 1/2	13 7/8	28/5
1	BEND	16 1/2 PL 166 X 1 3/4	13 7/8	29/9
1	BEND	16 1/2 PL 166 X 2	13 7/8	14/9
1	BEND	16 1/2 PL 166 X 2 1/4	13 7/8	14/9

QTY	MARK	MATERIAL	LENGTH FT. IN.	REMARKS
8	A18	SKIN PL ASSYS		
8	B18	SKIN PL ASSYS		
2	BEND	16 1/2 PL 166 X 1/2	26 4	ASTM A36
2	BEND	16 1/2 PL 166 X 3/4	38 1/4	ASTM A36
1	BEND	16 1/2 PL 166 X 1	64 1/2	ASTM A36
1	BEND	16 1/2 PL 166 X 1 1/4	13 7/8	8/6
1	BEND	16 1/2 PL 166 X 1 1/2	13 7/8	28/5
1	BEND	16 1/2 PL 166 X 1 3/4	13 7/8	29/9
1	BEND	16 1/2 PL 166 X 2	13 7/8	14/9
1	BEND	16 1/2 PL 166 X 2 1/4	13 7/8	14/9

SHOP WELD

QTY	MARK	MATERIAL	LENGTH FT. IN.	REMARKS
3	GILLET	2300	2	LINE 5"
4	FILLET	29/155	0	
2	FILLET	166	0	
2	FILLET	336	0	
4	REV	530	0	
3	REV	336	0	
2	REV	336	0	
2	REV	160	0	

ALL MAT'L A36 UN.

NO ITEM NUMBER 132
CONTRACT NUMBER D-4CN 68-70-C-0088

APPROVAL STAMP

APPROVED

LOWER SHAKA RIVER
RESISTANCE

25 SEP 1970

4 NOTED - A18
4 NOTED - B18
4 NOTED - B18

3

LSR70-0088-132-023

DESIGNED BY: EC	CHECKED BY: EC	DATE: 11-11-70	APPROVED BY: EC	DATE: 11-11-70
FLINT STEEL CORPORATION ONE 1800 N. 15TH AVE. OKLAHOMA 73104 ENGINEERING DEPARTMENT				
SKIN PLATE ATTACHMENT LOWER SHAKA RIVER RESISTANCE OKLAHOMA, WASH.				

70-C-88-370

1. ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE SPECIFIED.
 2. ALL DIMENSIONS ARE TO FACE UNLESS OTHERWISE SPECIFIED.
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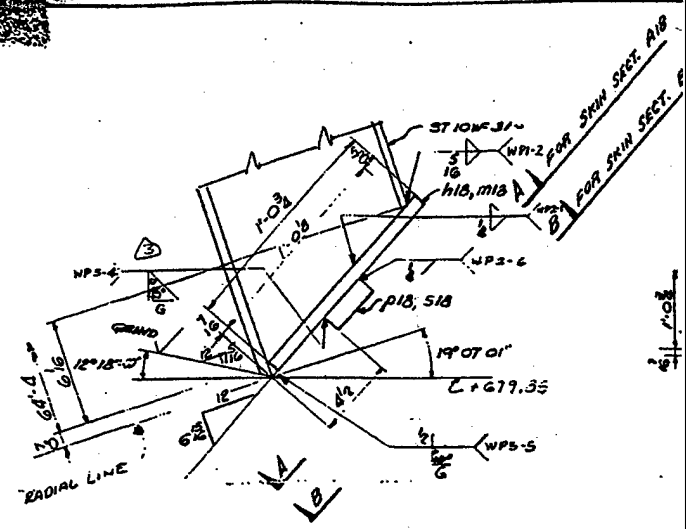
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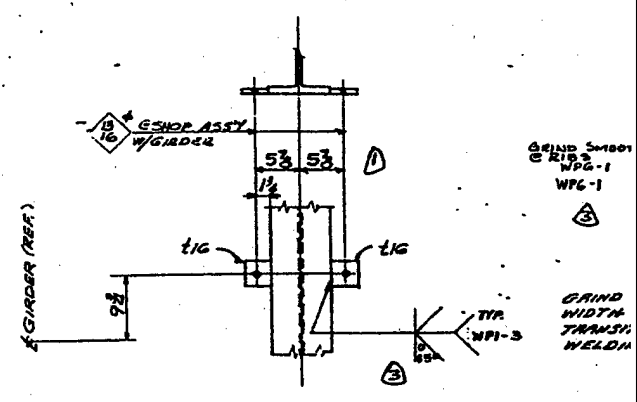
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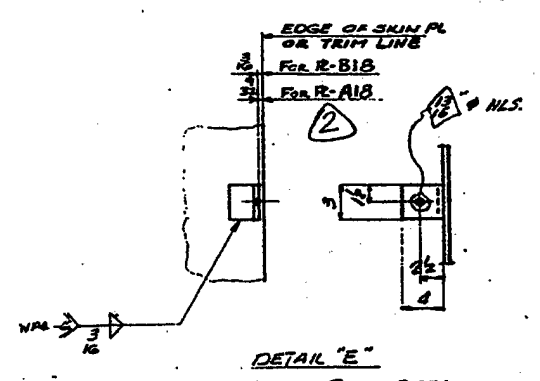
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DETAIL "A"

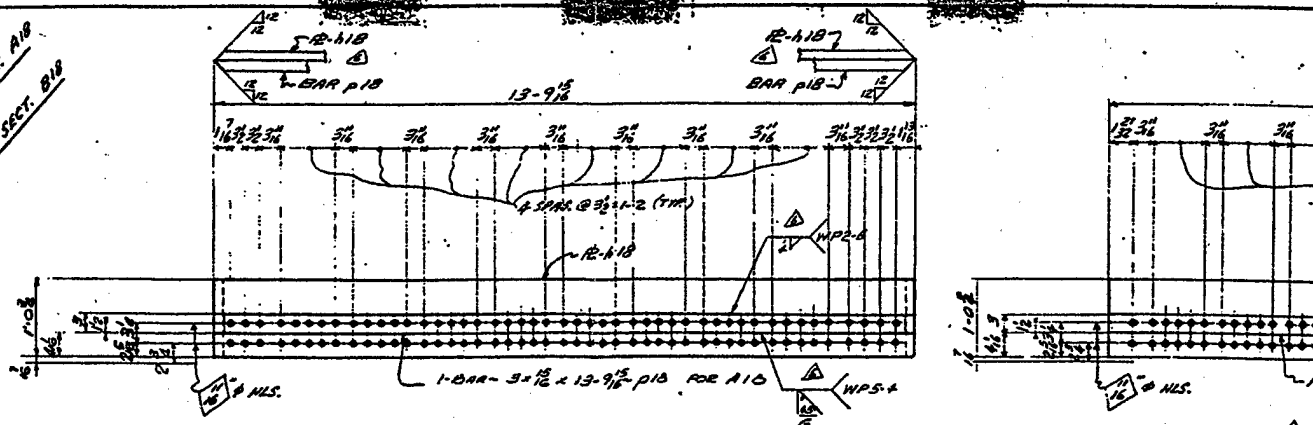


DETAIL "B"
(TYP. RIG TO GIRDER CONN.)

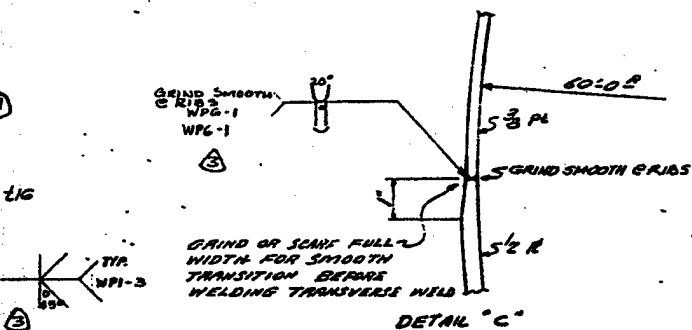


DETAIL "E"
ERECTION CLIP DETAIL

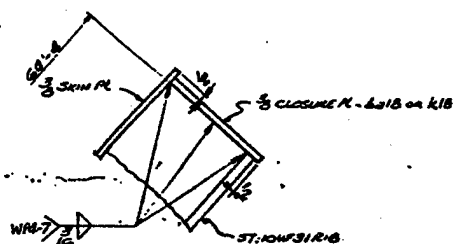
THIS DRAWING AND INFORMATION IS FOR THE USE OF THE CUSTOMER AND IS NOT TO BE REPRODUCED OR TRANSMITTED IN ANY FORM OR BY ANY MEANS, ELECTRONIC OR MECHANICAL, INCLUDING PHOTOCOPYING, RECORDING, OR BY ANY INFORMATION STORAGE AND RETRIEVAL SYSTEM. THE CUSTOMER SHALL BE RESPONSIBLE FOR OBTAINING ALL NECESSARY PERMITS AND APPROVALS FOR THE CONSTRUCTION OF THE PROJECT. THE CUSTOMER SHALL BE RESPONSIBLE FOR OBTAINING ALL NECESSARY PERMITS AND APPROVALS FOR THE CONSTRUCTION OF THE PROJECT.



SECTION A-A
(FOR SKIN SECT. A18)



DETAIL 'C'



DETAN 'D'

CONN.

24 SKIN PL

318

118. $\Delta^{\circ} \text{H}_{\text{f}}^{\circ}$

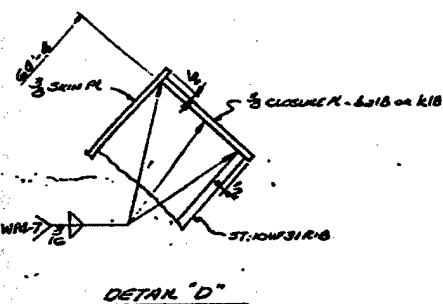
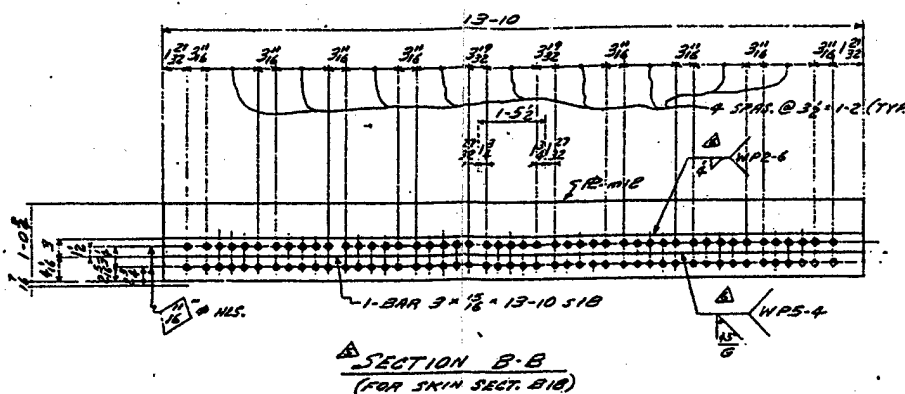
IP DETAIL

WORK THIS
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1	SHOW DETAILS & NOTES @ SECT. A-A & B-B	DATE	12-27-77
2	DRILL W/IN. TYPE B, SECT. A-A & B-B	DATE	12-28-77
3	CONVERT PLANS @ SECTION D-D, DATE @ SECT. A-A	DATE	1-5-78
4	REVISED VALVE SYMBOLS	DATE	1-5-78
5	REVISOR: DETAIL & FIN LETTERS @ 2-4-78	DATE	2-4-78
6	REV. FOR APPROVAL, JOHN DUNN: 3-15-78	DATE	3-15-78

PLINT
 DATE: 12-27-77



CUSTOMER'S P.A. NO.
CUSTOMER'S BUS. NO.

END ITEM NUMBER **132**
CONTRACT NUMBER **DAEW-68-70-C-0085**

APPROVED

Subject to conformity with plans and transportation
arrangements of areas of interest, and to following
any required laws. Approved and dated and stated details
captioned, as attaching for the following and furnished

**LOWER SNAKE RIVER
RESIDENT OFFICE**

25 SEP 1933

ESR 70-0088-132-024

FLINT STEEL CORPORATION
 2001 10TH ST. S.E. ALBUQUERQUE, N.M. 87102
 ENGINEERING & PARTS DEPT.

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 4. CITY _____
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70-c-88-371

1



PROJECT NAME
SHEET NO.
DATE

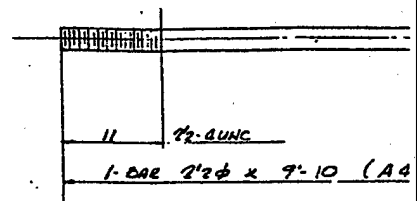
DESIGNED BY
CHECKED BY
DATE

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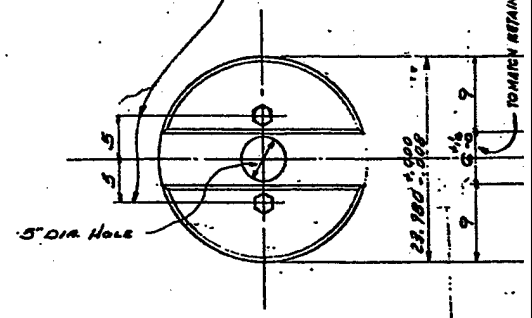
PROJECT NAME
SHEET NO.
DATE

DESIGNED BY
CHECKED BY
DATE



128 - STUD BOLTS

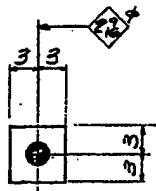
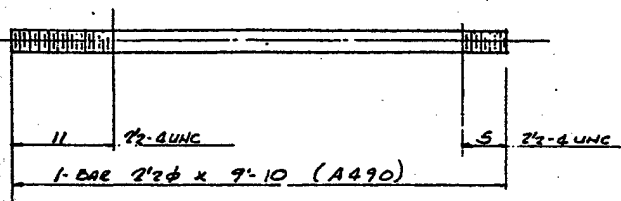
DRILL & TAP 1/4-7 UNC
x 2 1/2 DEEP - 1/4 x 12 H.A.



16-TRU

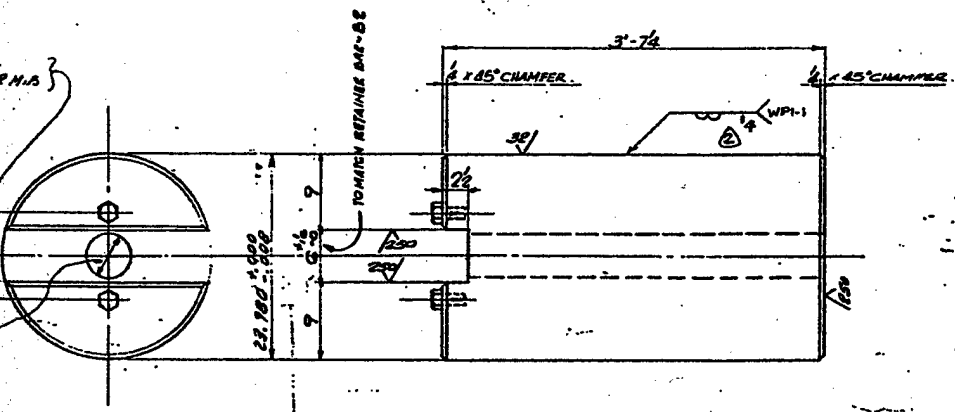
SH
USE 1/2
MADE IN
SPCS

NOTES:
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5. ALL DIMENSIONS ARE TO SURFACE UNLESS OTHERWISE SPECIFIED.



128~PL-6 1/2 x 10-G~B20 (A490)

128 - STUD BOLTS~A20



16-TRUNNION PINS~C20

STEEL FORGING ASTM A588 CLASS C1.
USE 3/8" FINISHED THICKNESS WELDED OVERLAY
MADE WITH E308-15 OR 16 ELECTRODE.
(SPECS PL TP-17-70 OPTION 2)

2

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	PARTS: _____	WELDED BY: _____					
	FROM: _____						

NO.	MARK	MATERIAL	QTY.	REMARKS
102	A3	2" ϕ STUD BOLT	9	10 A490 73
123	B9	PL G-34	0	G A490
16	C20	PIN 24" ϕ	3	74 SEE DETAIL
32		14" MA	0	2 TYPICAL 16" MA 117 FF-B-5756
FIELD BOLTS (ACTUAL COUNT)				
32		1" MA	0	G WEA. HD. TND. 3 3/4" NON-HR FF-B-5756
104		5/8" MA	0	24 WEA. HD. NON-HR
124		5/8" MA	0	82 CORR. PL
144		5/8" MA	0	34 CORR. PL CORR. PL
104		5/8" FLAT WASH		
1152		5/8" LOCK WASH		
256	D20	2" ϕ HEX NUTS		A490
128	E20	2" ϕ RAT WASH		A490
SHOE ASSEMBLY & FIELD PIN-UP BOLTS (ACTUAL COUNT)				
104		3/4" MA	0	2
32		3/4" MA	0	84
64		3/4" MA	0	84
32		3/4" MA	0	3
64		3/4" MA	0	54
64		3/4" MA	0	14
104		(3/4" ϕ MA)	-	-
(TO BE REMOVED FROM TENDERS)				
(BRACES AFTER SHOE ASSEMBLY)				
112		3/4" H.S.B. 4325	0	2

SIO ITEM NUMBER 132
CONTRACT NUMBER D9CW-6830-C-0082

Subject to availability of funds and upon receipt of approval of the Board of Directors, the following are approved: \$10,000.00 of the amount of \$100,000.00 to be expended for the purchase of the property and the building.

LOWER SNAKE RIVER
RESIDENTS' OFFICE

RESIDENTIAL

LSR 70-0088-133-02

70-C-88-377

OCT 13 1981